Resort Real Estate:
An Economic Analysis of Second Home Pricing Behavior in Park City, Utah

by

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ABSTRACT

The purpose of this research project is to examine the market pricing behavior of vacation homes in resort property markets. To accomplish this a price index is constructed to track real price fluctuations from 1981 to 2010 for the 3 localized ski resort markets in Park City, Utah. The resulting price indices reveal a history of cyclical price movements, and surprising long-term real price depreciation of 12% to 25% between 1981 and 2010.

To determine the causes of the cyclical movements in the price indices, time series analysis is performed, and a model created to predict market behaviors based on past levels of price, construction, and skier days.

The results of this exercise reveal that the number of annual skier days in the area is an effective representative of demand for housing, and that the local ski business has a considerable effect on real estate prices. Additionally, it is revealed that Park City's ski business is largely affected by national economic conditions, more so than by both regional economical conditions and local snowfall.

The analysis concludes that despite the thirty year decline in real prices, the Park City resort market behaves as a well functioning, healthy market. The model indicates that while increases in prices do stimulate new construction, the growth in the total number of dwelling units reveals a relatively inelastic supply market. This suggests that any growth in demand should be accompanied with long-term price appreciation. Market forecasts based on various demand scenarios indicate that except in the most pessimistic cases, prices in Park City should experience healthy appreciation in the near to mid future.

It is believed that these findings can be applicable to various resort markets.

Thesis Supervisor: William C. Wheaton
Title: Professor of Economics

Acknowledgements

I would like to express gratitude to my thesis supervisor and economics professor William Wheaton for making this project possible with his clear and patient guidance throughout the thesis process. Thanks are also owed to the Park City Board of Realtors for providing the sales transaction data needed to complete this research project.

I would also like to thank the faculty and staff of the Center for Real Estate for their contributions to a fantastic educational experience. Finally, I would like to thank my parents, my uncle John Williams, and the rest of my family for their support throughout the academic year.

Table of Contents

1.0 Introduction

Over the past decades second home development has become more and more prevalent and a strong economic force. Investors have increasingly been purchasing second homes in recreational and resort settings located adjacent to oceans, golf courses, lakes, and mountain resorts. The U.S. Census Bureau estimates that 7.9 million vacation homes exist in the United States today, compared to approximately 75 million owner-occupied homes. According to the National Association of Realtors' (NAR) *2009 Investment and Vacation Home Buyers Survey* the number of vacation homes sold in 2009 increased 7.9% to 553,000, from 513,000 in 2008 - 10% of the overall residential market share[1]. The increase suggests that buyers are starting to take advantage of bargain prices resulting from the recent economic downturn. The majority of the survey participants indicate that the primary purpose of their new vacation home is to function as a family and recreational retreat. However, 29% of the participants state that portfolio diversification is one of the most important motivators for their purchase. While it is understood that vacation homes can provide an annual yield – whether it be a utility or a rental yield – it is questionable whether or not they can be expected to provide long term appreciation. While the cyclical movements of primary residential markets and commercial property markets have been well researched, there have been few publications that have specifically studied markets for second homes. The objective of this paper is to examine the investment performance and economic behavior of vacation homes in the destination ski resort market of Park City, Utah. Park City is a 4-season resort community, and the home of three destination ski resorts: Park City Mountain Resort, Deer Valley, and The Canyons (located just outside city limits).

To complete this study historical residential sales data was collected for sales transactions from 1981 to 2010 for condominiums located near the base of each of the Park City ski resorts. With this data a property price index is constructed for each of the three resorts, to track prices as a function of time from 1981 to 2010. The indices are created by applying multiple regression analysis to the sales data to control for the variable attributes that contribute to the price of

[1] National Association of Realtors. Second Homes: Talking Points. 10 March 2010. 6 July 2010 <http://www.realtor.org/press_room_secured/public_affairs/tpsecondhomes>.

housing.[1] The three price series all reflect similar fluctuation patterns over the index period, and they appear to be very recessionary, reacting largely to the growth of the national economy. Over the 29 year period nominal prices show a moderate overall increase of approximately 100%, while real prices have failed to keep pace with inflation, reflecting a decrease of approximately 18%. It should be noted, however, that after a steep decline between 1981 and 1988 prices trended up considerably until peaking in 2007 before the recent downturn. A comparative study between the three indices is performed, and it is interesting to observe that Deer Valley, considered the more luxurious of the resorts with larger, more expensive units, appreciated less throughout the years of substantial growth, but also appears to have started to recover the soonest.

The price series fluctuations for Park City and Deer Valley are next examined using traditional econometrics. External variables such as skier visits (a measure of demand), construction permits (a measure of change in supply), interest rates, regional and national income levels, unemployment levels, job growth, and natural snowfall are gathered to explore the causes of the price fluctuations by way of multiple regression analysis. The price index and variables are used to construct a time series model and a series of equations is assembled as a conditional econometric forecasting model. The series of equations are used to predict skier days, real estate prices, and construction permits.

The model reveals that while snowfall does have an effect on the number of annual ski days, the region's ski business is influenced more by long term economic growth, particularly at the national level, which can be explained by the area's character as a national ski destination. The study also confirms that real estate price appreciation in the area can largely be explained by the area's ski business (a measure of demand) as compared to the number of dwelling units in the market. The study concludes that Park City's supply of residential units is relatively inelastic, such that new supply reacts appropriately to fluctuations in price, indicating that the market is essentially healthy and well behaved.

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[1] Miller, Norman G. "Residential Property Hedonic Pricing Models: A Review." Research in Real Estate, Vol. 2. JAI Press Inc., 1982. 31-56.

To further support the research findings a 15-year conditional forecast model is created to examine the response of skier days, price, and new construction to different economic scenarios: realistic, pessimistic, and optimistic. The model observes impulse responses to exogenous demand shocks that are caused by increases in annual snowfall and national disposable income levels. The market behaves appropriately in all tested scenarios. In response to a forecast of average snowfall and moderate income growth the model predicts a steady increase for both price and stock. In the optimistic scenarios with multiple years of near record snowfall and sustained income growth real estate prices show a dramatic increase, and the new supply market responds with a boom in construction. Even in the most pessimistic scenarios, with snowfall decreasing permanently to near record lows and curtailed economic growth, prices react by dropping considerably, but construction appropriately drops nearly 55% over a 5 year period and prices start to recover in year six.

In spite of the 12% decrease in real prices since 1981 which might suggest the contrary, the study results indicate that the real estate market of Park City Utah is a healthy, well behaving market.

1.1 Literature Review

The 2005 Journal of Real Estate Research contained a study similar to this paper that examined the New England Ski Market[1]. In this study Wheaton discovers that *real* prices of real estate at Loon Mountain Ski Resort depreciated by approximately 40% over a period of 25 years. A similar time series and conditional forecasting model is created which indicates that the New England Ski Market, represented by the number of annual skier days in the region, is largely affected by natural snowfall, more-so than by the region's long term economic growth or business cycle. The study also indicates that price appreciation at Loon Mountain can be explained closely by the regional ski business in comparison to the stock of units. The examination of the impulse responses in this study revealed that the new supply market at this resort responded so elastically to any movement in price that appreciation would be non-existent due to overbuilding. In nearly all scenarios any positive demand shock would result in a

[1] Wheaton, W. C., "Resort Real Estate: Does Supply Prevent Appreciation?" *Journal of Real Estate Research* ,Vol *27*, 2005.

building boom, and real prices would eventually fall below the pre-shock levels. Wheaton concludes that investment in the New England Ski Market would not likely produce any real appreciation.

In 2008 the MIT Center for Real Estate released a thesis authored by Sean Lee which conducts a similar research study to this and the one authored by Wheaton. Lee creates a price index for properties near Heavenly Ski Resort in the Lake Tahoe, California market for the years 1998 - 2000[1]. The results of the Tahoe study are drastically different from those of the New England market. Real housing prices in Tahoe remained essentially flat between 1988 and 1998 but then increased nearly 300% until the peak in 2006, before falling 20% through 2008. In contrast to the market in New England, the study determines that the supply market in Tahoe is quite constrained due to its age, size, and stringent building regulations, which seriously impede new development. High demand also plays a role as Tahoe is a true four-season resort that experiences high year-round traffic due to its proximity to the Northern California population, the lake and other summer amenities, as well as the Nevada casinos. The ski business in the Tahoe market is highly affected by both snowfall and regional and national economics as it gets weekend business from all over Northern California, but also serves as a destination resort nationally. As most destination travelers plan their ski vacations long before the snow season begins, their business is less dependent on the current year's snowpack, and more reliant on the economic growth of the previous year.

The papers completed by Wheaton and Lee examine different markets of two very different resorts, and indicate completely unique results. This paper examines the market of Park City, Utah, chosen in part because it also is different from the markets previously studied. The Park City market falls somewhere in the middle of the spectrum between these other two resorts, and it contains many characteristics that might be more typical of a destination ski resort. It is hoped that this study will be able to provide insight into the determinants of price appreciation and cycles in the resort/vacation home industry.

[1] Lee, Sean. "Second Home Real Estate Market: Economic Analysis of Residential Pricing Behavior Near Heavenly Ski Resort, CA." 2008.

2.0 Background

2.1 Park City, Utah

The state of Utah boasts the slogan "Greatest Snow on Earth" and is the home of thirteen ski resorts, eleven of which are located within a one-hour drive of Salt Lake's International airport, and seven within a 45 minute drive. While most of these resorts have a large number of lifts and extensive trail networks, Park City, Utah is the area that has been most developed into a resort destination with extensive condominium and lodging development, and a vibrant mountain town with restaurants and nightlife. Park City is the home of three world-class ski and summer resorts: Park City Mountain Resort, Deer Valley, and the Canyons (just outside of city limits). The city lies east approximately 36 miles from the Salt Lake International Airport, 32 miles from downtown Salt Lake City, and can be reached with an estimated drive time of 40 minutes via Interstate 80.

Park City was first settled in the late 1960's as a silver-mining town and was incorporated as a city in 1884. The town evolved into a thriving "boom" town and in its heyday at the turn of the century reached a remarkable population of 10,000 and was home to the Silver King Coalition mine, the country's richest silver mine. With the decline of the mining industry, the population slowly diminished to 1,150 in 1951 and Park City started to decay into a decrepit "ghost" town. However, in 1960 United Park City Mines was looking to diversify, and in 1963 Park City was approved for a federal loan from the Area Redevelopment Agency to open Treasure Mountain (Park City Mountain Resort) on part of a parcel of mining land. The resort opened in 1963 with a gondola, a chairlift, and 2 J-bars, along with a 9-hole golf course, and had 50,000 skier visits its first season[1]. A sister ski resort named Park City West (The Canyons) was opened 4 miles west of Park City in 1968, and the Deer Valley Resort followed in 1981[2]. The opening of Park City Mountain Resort triggered the evolution of Park City from a decaying mining town to a thriving resort town. The resorts and town have continued to expand steadily up until 2002 when Park

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[1] Park City Chamber and Visitor's Bureau. "Economic and Relocation Package - Park City History." 2010. ParkCityInfo.com. 5 June 2010

[2] Deer Valley actually reopened a small resort called snow park that had operated on and off until it was permanently closed in 1968.

City was put into the national spotlight as host of many of the alpine events during the 2002 Salt Lake Olympic Winter Games.

Today Park City reports an estimated population of 8,066 residents, as well as a lodging capacity of 23,307[1]. Tourism is the primary economic driver of the area, as Park City houses approximately 600,000 tourists per year, and receives approximately 3,000,000 visitors per year[2]. It is also estimated that 60% of the 8,000 (approximate) dwelling units in Park City proper function as second homes.

2.1.1 Resorts

Park City Mountain Resort, located just a few blocks from Main Street in downtown Park City, is currently owned by Powdr Corporation, one of the largest ski resort operators in North America. The resort was opened in 1963 with the name of Treasure Mountain by United Park City Mining Co. with one Gondola, a chair lift, and two J-bars. Today the resort consists of 16 chairlifts, 3300 skiable acres, and 3100 vertical feet. The terrain provides skiing for all levels of skiing and snowboarding, including terrain parks to help attract the snowboard population which has grown considerably over recent decades. Park City has long been marketed as one of the higher end destination resorts in the Rocky Mountains. It has been a perennial host of the World Cup since 1985, and hosted 4 different events during the 2002 Winter Olympics. Park City also provides summer recreational opportunities with a concrete sled track called the Alpine Slide, a zip line ride, children carnival rides, miniature golf, as well as lift served mountain biking and hiking. Park City has been voted one of the top 5 resorts in North America in Ski Magazine multiple times, including the most recent poll.

Deer Valley is located approximately 1.5 miles east of Park City. The resort opened in 1981 on the former site of a small ski area entitled Snow Park Ski Area that operated on and off between 1946 and 1968 and consisted of just a couple of ski lifts constructed from lodge-pole pines taken directly from the site. Deer Valley is smaller than the other two Park City resorts with 2,026

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[1] Park City Municipality. "Park City: Quick Facts." 1 1 2010. ParkCity.org. 6 6 2010 <http://www.parkcity.org/index.aspx?page=279>.

[2] Park City Chamber and Visitor's Bureau. "Economic and Relocation Package - Tourism." 2010. ParkCityInfo.com. 5 June 2010

skiable acres. To compete with nearby resorts Deer Valley has marketed itself as an exclusive high-end resort, catering to a higher-end clientele with amenities such as free ski valets and parking shuttles, fine dining and shopping, more frequent grooming of slopes, and limited access to avoid overcrowding. It is one of only three resorts remaining in North America that does not allow snowboarders. Deer Valley was also host of four different Olympic events during the 2002 games and hosts international freestyle ski events every year. The resort has been named #1 ski resort in North America by Ski Magazine four times in the last eight years, including the three most recent polls.

The Canyons Ski Resort opened in 1968 with the name of Park City West as it was located just 4 miles west of its sister resort, Park City Mountain Resort. Its name was changed shortly thereafter to Park West, and then again to Wolf Mountain in 1995. After being purchased in 1997 by American Skiing Company the resort was renamed The Canyons and underwent the start of a $500 million expansion plan that would increase the skiable acres of the resort from 1400 to 3700 by 2007, making it the largest resort in Utah, and one of the 5 largest in the United States. The expansion included major amenity improvements including new lodges, condominiums, and a recently constructed Waldorf Astoria hotel. American Skiing Company was recently dissolved, and the resort was purchased in 2008 by Talisker, a Toronto based real estate development firm. The Canyons is located outside of the Park City municipal boundaries along Highway 224 which connects Interstate 80 to Park City, in an unincorporated area known as South Snyderville Basin.

3.0 Real Estate Data

3.1 Supply

To appropriately study market pricing behaviors over a specified time period it is necessary to measure the change in supply over that period. In the real estate market, the supply variable is represented by stock, defined as the number of dwelling units located within that market. The change in supply is represented by the amount of new construction within the same market. For this study, the new construction data was provided by the Park City building department, which had tracked the number of residential building permits issued annually within the Park City municipal boundaries from 1980 to 2009. The annual change in supply is therefore calculated simply by using the number of existing dwelling units in Park City as reported in the most recent U.S. census of 2000, and increasing/decreasing that number by the number of new housing construction permits each year. Figure 1 illustrates new construction and total housing supply between 1980 and 2010. A table listing annual housing permits and stock can be found in the Appendix.

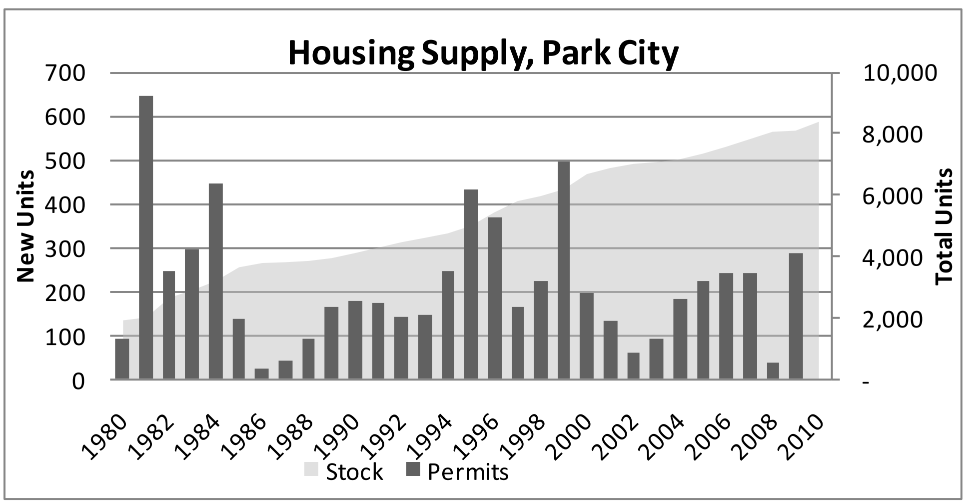

Figure 1 – New Construction & Housing Supply, Park City, Utah - 1980-2010

The number of housing units in Park City encompasses both the Park City and Deer Valley markets as both resorts lie within city boundaries, just over one mile apart. While the available data does not allow differentiation in supply between the two resorts, the stock / permit series are considered good indications of the change in supply for the overall Park City resort market. A follow up study breaking down the overall supply market into submarkets could be interesting.[1]

3.1 Price Index

It can be difficult to track true market-wide price appreciation for housing due to the heterogeneous nature of the housing market. The purchase price of a home can be viewed as the combined value of the multiple attributes that each contribute to the value of that home. Home values are therefore difficult to predict, and to compare apple to apples, due to the fact no two houses are the same. There are many different variables that contribute to the value of a home, including, but not limited to: square footage, number of bedrooms and bathrooms, lot size, age, quality, location, views, and layout. The amount that each individual characteristic adds to the value of a house in a particular market is difficult to discern by mere observation, but can be measured by estimating what is called an hedonic price equation[2]. An hedonic price equation is an econometric tool that is derived by using multiple regression analysis against a series of data to determine the effect that each observable independent variable has on price, such that price is a function of the observable values of each of its individual attributes, as follows[3]:

$$\text{Price} = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \ldots.. + \beta_nX_n \qquad \text{(Eq.1.1 – Linear)}$$

(or)

$$\text{Price} = \alpha X_1^{\beta 1}X_2^{\beta 2}X_3^{\beta 3}\,X_4^{\beta 4} \ldots.. + X_n\beta_n \qquad \text{(Eq.1.2 – Exponential)}$$

α - Intercept. (constant affected by ind variables to predict price)
X - Independent variable (observed value)
β - Coefficient (measure of effect that X has on α)

Equation 1 – Hedonic Price Equation

[1] Park City housing supply numbers do not represent supply for The Canyons' housing market as The Canyons is located outside of the Park City municipal boundaries. Building Permits for The Canyons and its surrounding area are issued by Summit County, which has only tracked permits issued annually across the entire county, an area deemed too broad to be effective for this study.

[2] Miller, Norman G. "Residential Property Hedonic Pricing Models: A Review." Research in Real Estate, Vol. 2. JAI Press Inc., 1982. 31-56.

[3] DiPasquale, Denise and William C. Wheaton. Urban Economics and Real Estate Markets. Prentice-Hall, Inc. , 1996.

Hedonic regression analysis is a method commonly used to examine how consumers in a market value certain attributes, and can be beneficial in the process of both appraising existing real estate, and deciding if, what, and where a real estate asset should be built.

In a similar fashion an hedonic price equation can also be used to track true changes in price over a period of time. An effective housing price equation has broken down the values of a house into the increments of each of its individual attributes. The remaining constant, represented by "α" in the price equations above can be considered the base unit common to each of the sales transactions in the data set. By including a time "dummy" variable in the price equation for each time period in the data set, the resulting coefficient β_t can then represent the amount that prices in $time_t$ have shifted since the base period (t=0)[1]. After applying the price shifts for each period as indicated by the β coefficients, if all other attributes remain equal (which in the case of this study can just be left out), the result is a true housing price index – an estimate of the price of the base unit of measurement over time.

3.2.1 Price Data Collection

The Park City price indices in this research project are constructed using the hedonic regression analysis methodology described above. The problem with estimating an effective hedonic equation, however, is that large amounts of data are needed to help control for the many different attributes that effect price. Data on property sales over a 30-year time period is difficult to find, and the data that is found is not likely to include many of the observable attributes that are needed to effectively predict price. Some variables, such as quality and location which are both very influential pricing attributes, are quite subjective, and would be very difficult and time consuming to quantify. There is a separate pricing methodology known as the repeat sales model which is similar in that it tracks sales transactions over time, but only examines transactions in which the same house has been sold at least twice over the time period being researched[2]. This methodology eliminates the need for detailed quality attributes because it tracks price movements of the exact same asset.

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[1] DiPasquale, Denise and William C. Wheaton. Urban Economics and Real Estate Markets. Prentice-Hall, Inc. , 1996.

[2] DiPasquale, Denise and William C. Wheaton. Urban Economics and Real Estate Markets. Prentice-Hall, Inc. , 1996.

To help control for quality and location attributes in a manner similar to the repeat sales methodology, data was collected only for sales transactions of condominium units in large condominium projects located within 0.75 miles of the resort base and at least 25 years old. Unlike the repeat sales methodology, the observed transactions were not necessarily limited to those of units that sold more than once, but because condominium units in a particular complex are so similar, the results are essentially the same. The units in a particular complex all share the same location[1] and are constructed at the same time. They are also expected to be of uniform quality and layout when constructed. This eliminates the need to collect data for, and to assign observable values to, unit quality attributes.

To select which condominium projects to examine, the Summit County Assessor's Office provided a list of all condominium projects in the valley, organized by neighborhood. The list indicated the name and address of each project as well as the number of units and the date the project was platted. A number of potential projects were identified near each of the three resorts based on location, age, and number of units. A site visit to each project was then conducted to observe general quality and maintenance of the projects, and to identify which projects could collectively be representative of the market as a whole. 7 projects were selected to represent the Park City Mountain resort, containing a total of 590 units. 10 Projects with 385 units were selected in the Lower Deer Valley market, and 3 projects with 470 units were selected near the base of The Canyons.

The state of Utah is classified as a "non-disclosure" state which means that while changes in ownership of a real estate asset is recorded in the deed of registry, and made public, the transaction sales price is not. However, The Summit County tax assessor indicated that their source for transaction data to aid in the appraisal and tax assessment process is the Park City Board of Realtors. The Park City Board of Realtors was founded in 1980 and operates and maintains the Park City Multiple Listing Service (MLS). The Park City MLS is a service that compiles real estate sales data which is made available to members or subscribers to facilitate

[1] This method does not account for location differences within a condominium complex nor quality differences that might result over time due to individual unit ownership.

sales and track information. The MLS tracks all real estate transactions in the area that have been listed through the Board of Realtors, estimated to be 90% of all housing transactions. The database includes sales transaction data that is catalogued in computerized format back until 1993. Transactions prior to 1993 have been recorded and kept in old MLS listing booklets. The MLS data is not intended for public use, but The Park City Board of Realtors agreed to supply the data for this study due to its academic nature. A digital file, which contained the data for approximately 1700 sales transactions from the chosen condominium projects from 1993 to 2010, was provided. Additionally, the Board of Realtors provided access to the historical MLS Listing Booklets from which an additional 1300 sales transactions were manually recorded. Table 1 summarizes the data collected.

Sales Transaction Data			
Location	**Condo Projects**	**Units**	**Observed Transactions**
Park City	7	590	1,143
Deer Valley	10	385	957
Canyons	3	470	896
Data Observed:	Price	Bedrooms	Date of Sale
	Square Footage	Bathrooms	Condominium Complex

Table 1 – Sales transaction data

3.2.2 Index Construction

To construct the price index the price per square (PSQFT) for each sale in the data set is first calculated to be used as the dependent variable representing price in the hedonic equation. The independent variables used to estimate price are the remainder of the numerical data collected, including square footage, number of bedrooms, and number of bathrooms. These attributes help control for differences between each of the unit types in a particular condominium development. A separate dummy variable is used for each condominium project, which controls for variations in location, quality, and age. The coefficient (β) for these dummy variables will each represent the estimated difference between the price of units in the corresponding condo project and that of the base project. A time dummy is also used for each of the 29 years following the base year of 1981 to indicate the shift in price over time.

The regression analysis results indicate that the estimated hedonic price equation is quite effective, with an R square ($R^{2)}$ of 0.915 for the Park City Resort index. R^2 is a statistical measure that in this case indicates that 91.5% of the price can be explained by the various independent variables that have been included in the equation. An R^2 of 0.91 is quite high for an equation predicting price per square foot as opposed to total sales price.[1] The coefficients for each of the numerical variables are all statistically significant and coefficients all have the right signs. For example, the square footage variable in the Park City linear price equation has a negative coefficient (β) of -.053. This can be explained by the concept of diminishing marginal utility, in that an increase in square footage, while expected to increase the overall value of the house, will do it at a decreasing rate. A larger house, while worth more overall than a smaller one, will actually have a smaller price per square foot, all else equal. The variables of Bedrooms and Bathrooms, on the other hand, both have positive coefficients, indicating that an increased number of each of these attributes has a positive effect on price. The dummy variables for each of the apartment complexes are all significant, and prove to make sense in that the luxury condo complexes have a higher coefficient indicating a greater implicit value over the price of the base project. The coefficients for the time variables are very interesting and are reflected in the Price Index in Table 2 and illustrated in Figure 2. Full regression results for each price equation can be found in the Appendix. It should be noted that an hedonic equation was estimated in both linear and log form. The resulting price indices are nearly identical. The remainder of this chapter will be examining the linear price equations. See the appendix for an illustration depicting the Linear and Log equation for prices in Park City.

[1] Wheaton, W. C., "Resort Real Estate: Does Supply Prevent Appreciation?" *Journal of Real Estate Research* ,Vol *27*, 2005.

Hedonic Price Index						
	Nominal $ / SF			Real $ / SF		
	Park City	Deer Valley	Canyons	Park City	Deer Valley	Canyons
1981	$162.44	$195.41	$122.88	$162.44	$195.41	$122.88
1982	$134.58	$187.20	$128.65	$126.77	$172.71	$118.69
1983	$144.45	$186.33	$107.80	$131.83	$165.75	$95.90
1984	$138.71	$169.97	$102.92	$121.35	$145.12	$87.87
1985	$116.03	$154.71	$99.78	$98.03	$127.58	$82.28
1986	$108.26	$151.90	$78.09	$89.79	$120.58	$61.99
1987	$100.62	$129.20	$80.86	$80.51	$101.08	$63.26
1988	$102.72	$139.15	$82.57	$78.93	$104.63	$62.09
1989	$111.55	$144.22	$87.42	$81.77	$103.61	$62.80
1990	$120.37	$151.17	$92.25	$83.71	$103.23	$63.00
1991	$128.95	$146.27	$97.31	$86.06	$94.54	$62.90
1992	$123.64	$147.31	$99.85	$80.11	$92.80	$62.90
1993	$133.49	$156.79	$106.18	$83.97	$95.66	$64.78
1994	$158.30	$165.65	$132.65	$97.10	$98.57	$78.94
1995	$192.76	$186.89	$157.13	$114.97	$108.18	$90.95
1996	$230.56	$226.95	$179.24	$133.58	$127.88	$101.00
1997	$239.40	$237.36	$186.02	$135.59	$129.79	$101.72
1998	$246.42	$246.90	$202.84	$137.42	$132.92	$109.20
1999	$245.81	$245.41	$195.44	$134.12	$129.95	$103.49
2000	$232.88	$235.22	$185.49	$122.93	$121.23	$95.60
2001	$220.37	$233.52	$189.91	$113.11	$116.03	$94.36
2002	$221.05	$224.29	$185.20	$111.69	$110.18	$90.98
2003	$230.90	$233.73	$175.33	$114.07	$111.91	$83.95
2004	$261.44	$239.98	$196.67	$125.81	$112.73	$92.39
2005	$339.61	$306.93	$276.18	$158.07	$140.03	$126.00
2006	$506.63	$448.33	$371.35	$228.44	$196.70	$162.92
2007	$516.47	$457.05	$384.13	$226.42	$196.71	$165.32
2008	$468.92	$353.83	$313.08	$197.98	$145.84	$129.04
2009	$384.26	$341.43	$239.74	$162.81	$140.68	$98.78
2010	$341.64	$384.41	$228.45	$142.34	$154.34	$91.72
Annual Increase	2.60%	2.36%	2.16%	-0.45%	-0.81%	-1.00%
(Observations)	1141	957	896			
(R*2)	0.9153	0.8969	0.9378			

Table 2 – Hedonic Price Indices

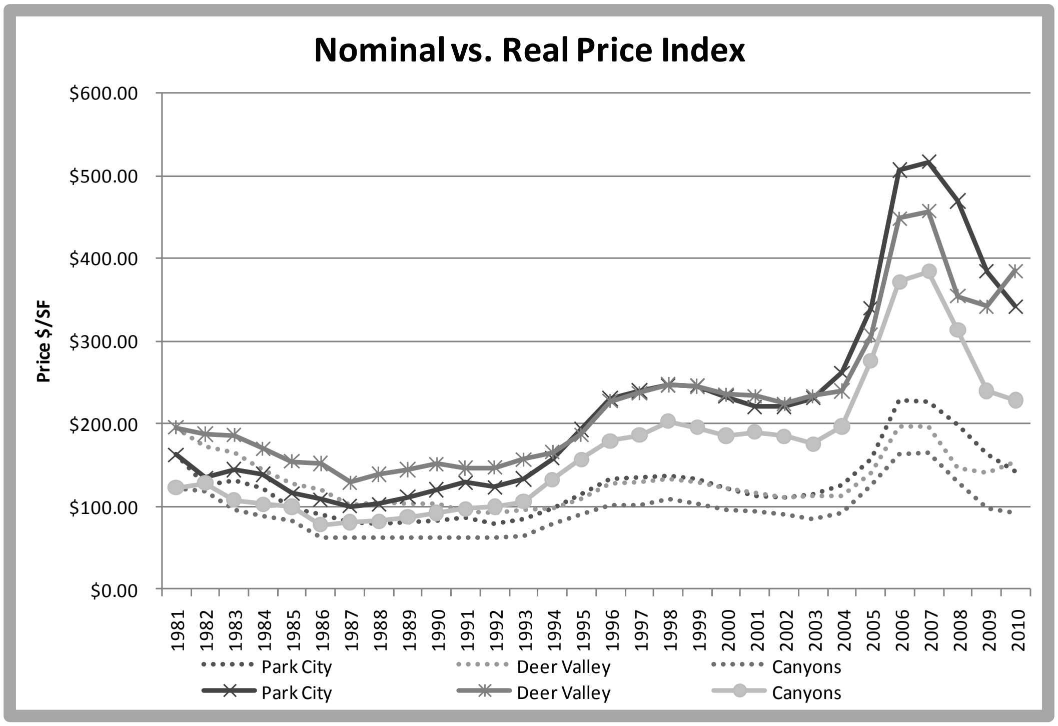

Figure 2 – Nominal Price Index as compared to Real Price Index and New Construction

3.3 Index Analysis

The results of the hedonic price indices are quite interesting. At first glance at nominal prices the cyclical nature of the real estate market is revealed. The three property price indices essentially follow identical patterns over the thirty year period. Nominal Prices increase 110% over this period, but this is only a 2.5% annual increase. What is most surprising to observe is that nominal prices for all three markets decreased approximately 35% between 1981 and 1987 and didn't recover to 1981 prices until 1995. It is also noticed that the overall market, similar to that of the rest of the country, experienced unprecedented nominal price growth of over 100% between 2003 and 2007, and has rebounded sharply with 30%-40% decreases since then. To enable closer examination, Figure 3 below illustrates the real price indices together with annual building permits

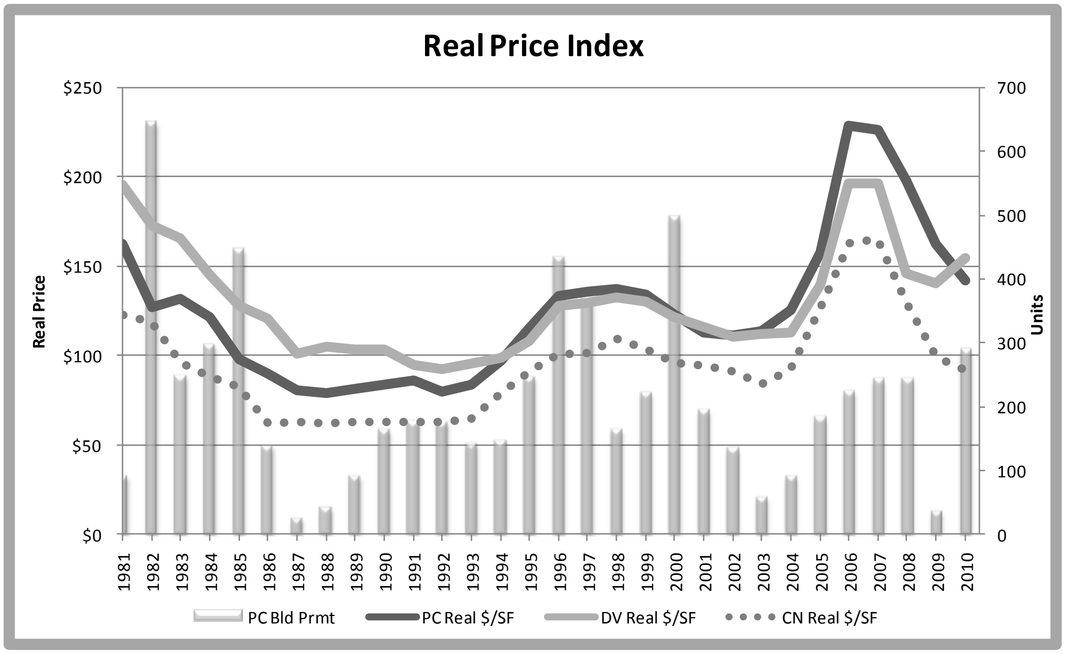

Figure 3 – Real Price Indices and New Construction

After adjusting for inflation we can take a closer look at real price changes over the last 30 years. Real prices have failed to keep up with inflation since 1981, having decreased by a total of 12% in the Park City resort market, 18% at Deer Valley, and 25% at the Canyons. What is most astonishing is the drastic change in price between 1981 and 1987. Prices fall across the board to approximately 50% of their 1981 values where they basically remain constant until 1992 and 1993. At this point prices begin to recover, but they don't reach 1981 levels again until the frenzy of the most recent housing bubble in 2006. Deer Valley prices, in fact, at the peak of the market in 2006, only exceed 1981 prices by 3%.

While we don't have data for prices in park city before 1980, it can be derived that 1981 was the tail end of an inflated real estate cycle similar to many markets across the country. The downward response to these inflated prices was likely exacerbated by record construction numbers in 1981 as well as an abnormally high inflation rate of 6%. As prices hit bottom in 1987 construction comes to a standstill, and only gradually picks up the next couple of years. Any price recovery at this point is stymied by four straight years of 4%-5% inflation.

In 1992 prices begin to rise again increasing 72% through 1998. It is interesting to note that 1995 is the year that it was announced that Salt Lake City would host the Olympics of 2002.

This announcement likely contributes to two straight years of 16% annual price increases in Park City through 1995 and 1996. It likewise contributes to two years of extremely high construction in 1996 and 1997.

In 1998 prices level out and soon take a negative turn as the dot.com bubble bursts. Real Estate prices decrease 20% through 2002 before the real estate bubble causes a 104% price increase from 2002 – 2006, followed by a price drop of nearly 40% through May of 2010.

3.3.1 Comparison of Park City to Deer Valley

Comparing Deer Valley to Park City has provided some interesting observations[1]. The price indices reveal that during market downturns the Park City and Deer Valley real estate prices have reacted nearly identically, however during periods of price growth the Park City market has repeatedly outperformed Deer Valley. See Table 3 for details.

Cyclical Comparison						
% Change in Price Index in each cycle						
	1981-1992	**1992-1998**	**1998-2002**	**2002-2006**	**2006-2009**	**2010**
Park City	-51%	72%	-19%	105%	-29%	-13%
Deer Valley	-51%	44%	-18%	78%	-28%	11%

Table 3 - Cyclical price comparison, Park City vs. Deer Valley

From 1981 – 1992 both indices reflect a 51% decrease in price. However, the following growth period from 1992-1998 results in a 72% increase in Park City prices but only a 44% increase for Deer Valley. Figure 4 illustrates this observation. Along the same lines Park City and Deer Valley experience a 19% and 18% price reduction from 1998 – 2002. However, price increases in the real estate boom of 2002-2006 are observed to be 105% for Park City compared to 78% for Deer Valley. Finally, the indices indicate a similar price decrease of 28% and 29% until 2009, before the sudden 11% price increase in Deer Valley during the first 5 months of 2010.

---

[1] The focus of this research paper is the Park City Resort market, with some comparisons to the Deer Valley market. The Canyons is located outside of Park City limits, and therefore was not able to be examined relative to the housing stock. The Canyons Price Index was included in this Chapter as a comparative measure reflecting cycles across separate nearby markets, but will not be examined further.

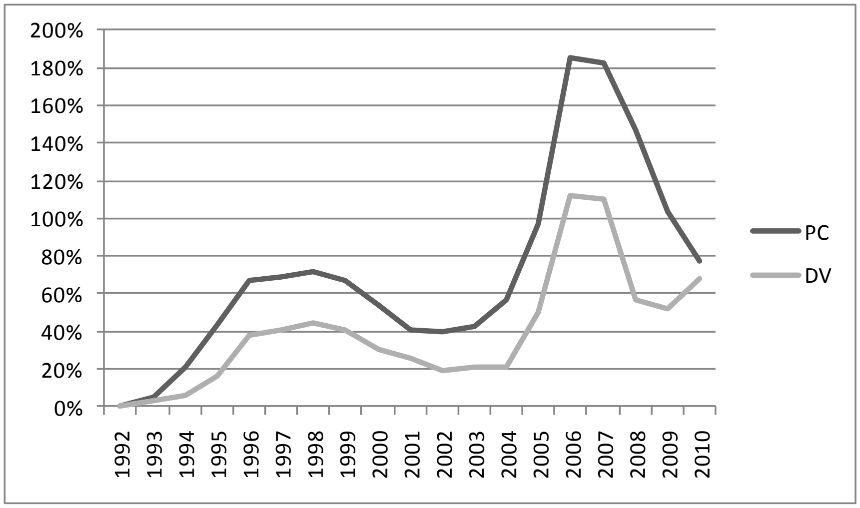

Figure 4 – Percentage Change in Price Index – Park City vs Deer Valley 1992-2010

The difference in appreciation between the two resorts might be attributed to a slight positive location bias in the Park City index due to a supply constraint in its immediate surrounding area. The Park City Resort market has been around longer, is located adjacent to historic downtown Park City, and is relatively mature. It is difficult to find development sites comparable to those upon which the Park City price index is based. In fact while there has been considerable development in Park City proper, few new projects have been completed adjacent to the Park City resort in the time period of our study. On the other hand, in Deer Valley, which is considered the more luxurious and expensive location, the resort opened in 1981, and most of the development surrounding the resort has taken place after this date. While the condominium projects examined in the Deer Valley study are all excellently located in Lower Deer Valley, there have been a number of new developments with comparable locational value since 1981. In fact, the neighborhood known as Upper Deer Valley has essentially been developed in its entirety since 1981, and would probably be considered a higher-end location. It could be that new development surrounding Deer Valley has actually prevented price appreciation in the area from keeping up with the neighbor resort. It would be interesting to break down the new construction numbers over the study timeframe into submarkets to examine the more immediate effects of new supply on prices between the resorts.

3.4 Conclusion

In spite of the 12% overall decrease experienced in Park City property values over the past 30 years the price index actually reveals a positive linear trend. A final observation to consider is the 70% real price increase in Park City from 1990 to 2010. This 20-year period covers 2 full real estate cycles, measured from trough to trough (assuming that prices have neared the bottom of the current downturn, which may not be the case). The 2.69% annual increase in real price throughout this time period is a healthy increase and encourages the likelihood of future price appreciation in the Park City market.

4.0 Time Series Analysis

To study the determinants of movements in the property price indices a time series analysis is performed. This is done by using multiple regression analysis to estimate hedonic equations which predict new building supply, skier days (demand), and price. These three equations are then used to create an econometric model which is classified as a conditional *Vector Autoregression Model* (VAR). A VAR examines the evolution and interdependencies between multiple time series of different variables. In this study the interdependent variables in the VAR are Price and Stock, while Skier Visits is observed as an exogenous demand variable. To complete this model a time series was collected for each of the following variables:

TIME SERIES DATA

Variable	Definition
Included in Model:	
$Stock_t$	Stock of housing in Park City Municipal
$PCSkiDay_t$	Skier Visits in Park City Area
$SNWF_t$	Park City Snowfall
$PRPrice_t$	Price Index for Park City and Deer Valley
$DVPrice_t$	Price Index for Deer Valley
$Permit_t$	New construction permits for Park City Municipal
$USINC_t$	United States real disposable income per capita
Examined but disregarded from model due to insignificane:	
$Rate_t$	Interest Rate
$RMINC_t$	Rocky Mountain disposable income per capita
$UTINC_t$	Utah disposable income per capita
$UTSKiDay_t$	Skier visits in Utah
$USEMPL_t$	US Employment

Table 4 – Time series data, variables and definitions

4.1 Park City Skier Demand

Skier Visits has been identified as a good measure of ski resort housing demand, due to the fact that it represents a number of potential of renters and buyers of housing in resort areas.

The National Ski Areas Association (NSAA) defines a skier visit as "one person visiting a ski area for all or any part of a day or night for the purpose of skiing."[1] Annual skier visits is a measure of the number of skier visits in a specified geographical region per ski season, which is generally November – April/May. We were not able to track annual skier visits for the individual resorts that we are examining, due to the fact that resorts keep that information private. Ski Utah is a trade organization that promotes the Utah ski industry and publishes annual skier visits in the state of Utah dating back to 1980[2]. The Park City Chamber of Commerce and Visitors Bureau also publishes annual skier visits for just the park city area, which consists of Park City Mountain Resort, Deer Valley, and The Canyons[3]. While the Chamber of Commerce had only published the skier data back to 1990, the staff provided the remaining data which dated back to 1983.

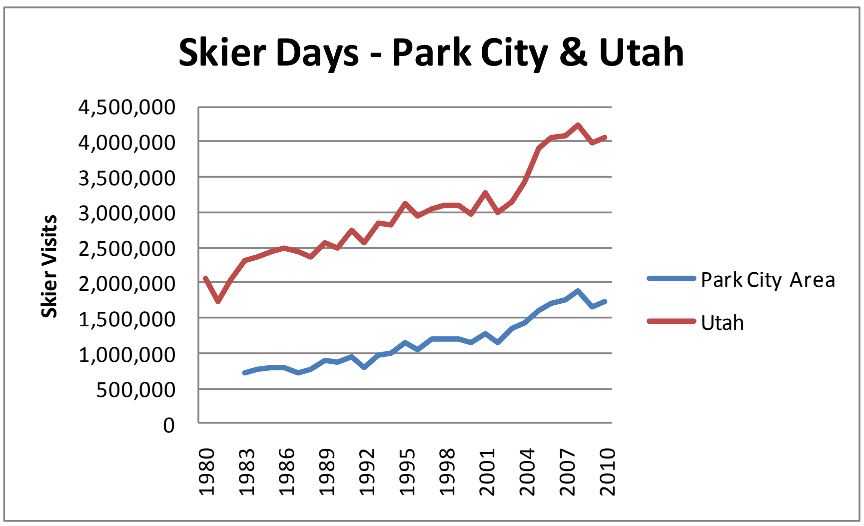

Figure 5 – Skier Visits (see table of data in Appendix)

The data reflects that skier days in both the Park City area and overall Utah market have followed similar cyclical patterns, with considerable growth over time. Park City skier days increased at a greater rate with a cumulative increase of 142% since 1983 compared to 75% for Utah skier days. The three Park City resorts accounted for 43% of Utah skier visits in the 2009/2010, compared to 31% in 1983. Growth in skier days in both Park City and Utah has

[1] (NSAA) National Ski Areas Association. "Estimated U.S. Ski Industry Visits by Region 1978/79 - 2008/09." 2009. www.nsaa.org. 1 6 2010 <http://www.nsaa.org/nsaa/press/historical-visits.pdf>.

[2] Ski Utah. "Utah Skier Days Table." 24 6 2010. www.skiutah.org. 24 6 2010 <http://www.skiutah.com/media/story_starters/utah-skier-days-table>.

[3] Park City Chamber and Visitor's Bureau. "Economic and Relocation Package - Park City History." 2010. ParkCityInfo.com. 5 June 2010 <http://www.parkcityinfo.com/docs/PARK_CITY%20HISTORY%202009.pdf>.

considerably outpaced that of the Rocky Mountain and national ski industries. See Figure 6 below to compare growth.

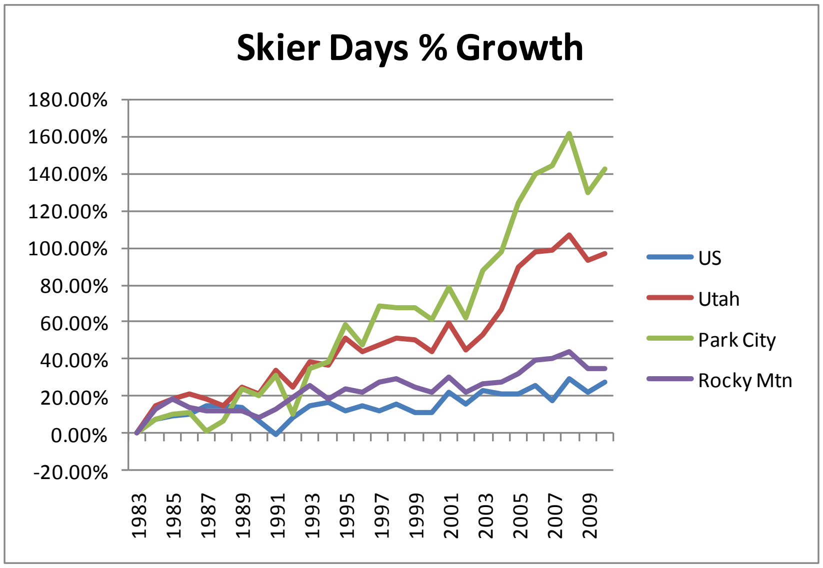

Figure 6 – Skier Day Growth, National Comparison

4.1.1 National Economic Data Series

To study the determinants of movements in the Skier Visit series, employment and income data were collected at the state, regional, and national level. The economic variable that proves most influential to the Utah ski business is real *disposable income per capita*[1]. Subsequently, data series of disposable income per capita of the Utah, Rocky Mountain, and the United States regions were all examined closely as part of various estimated equations predicting skier days. Not surprisingly, while all three series are observed to be influential the most effective economic determinant of the Utah and Park City ski business proves to be nationwide U.S. Disposable Income Per Capita (USINC). Equations were estimated using multiple variations of contemporaneous, first, and second order lags. The most effective Skier Day equation was estimated using the first order lag of $USINC_{t-1.}$ This is understandable, as Park City is a destination resort that depends largely on customers that visit on an extended vacation, from all over the country. Such vacations are generally planned far enough in advance that disposable income levels from the previous year appear to be the greatest determinant for the number of

[1] Unemployment rates and overall employment and income levels were also examined. Data Source: Bureau of Economic Analysis, US Department of Commerce, March, 2010.

visits. The fact that a second lag doesn't significantly improve the equation implies that disposable income growth generally stimulates a permanent increase in skier days.

Figure 7 below reflects Skier days compared to disposable income levels since 1983. While it is difficult to see the effect that minute changes in disposable income have on the fluctuations of skier visits, the graph does reflect the long-term growth pattern of both series[1]. The next figure (8) reflects percentage growth of skier days compared with percentage growth of $USINC_{t-1}$. This figure illustrates that a small increase in the growth rate of U.S. disposable income has a significant effect on the growth of Park City skier visits. The estimated equation predicting skier days is labeled Equation 2 in the next section.

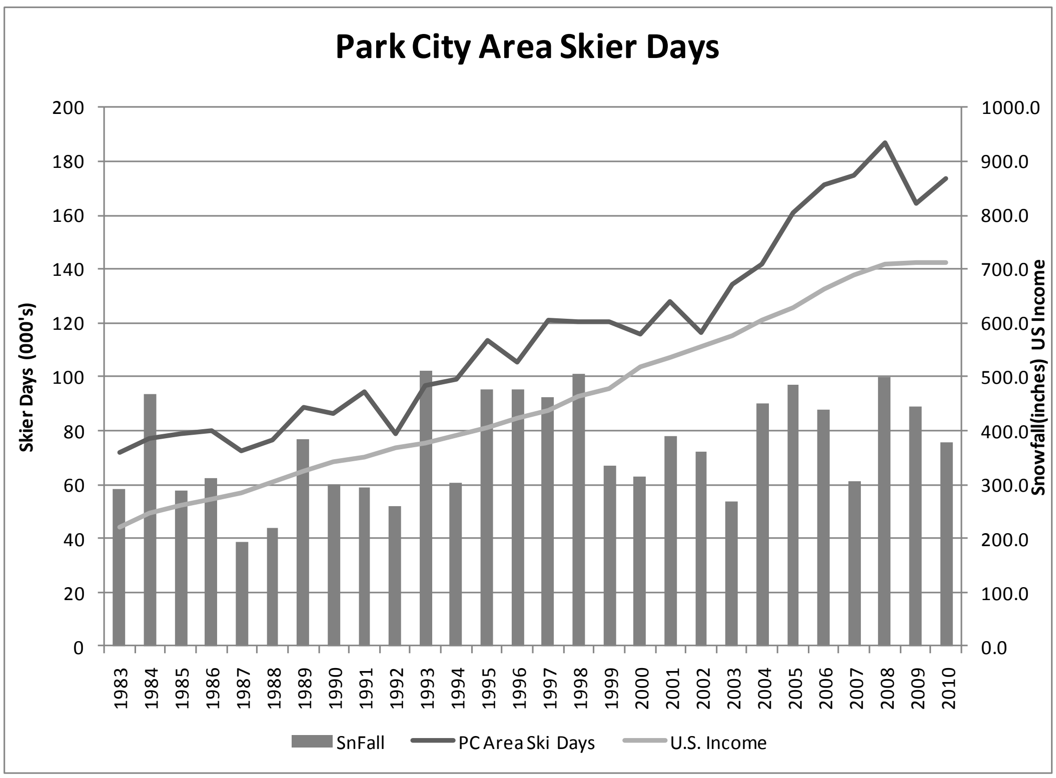

Figure 7 – Park City Skier Days, U.S. Disposable Income, Snowfall

[1] The average annual growth rate of U.S. real disposable income per capita is 1.36%

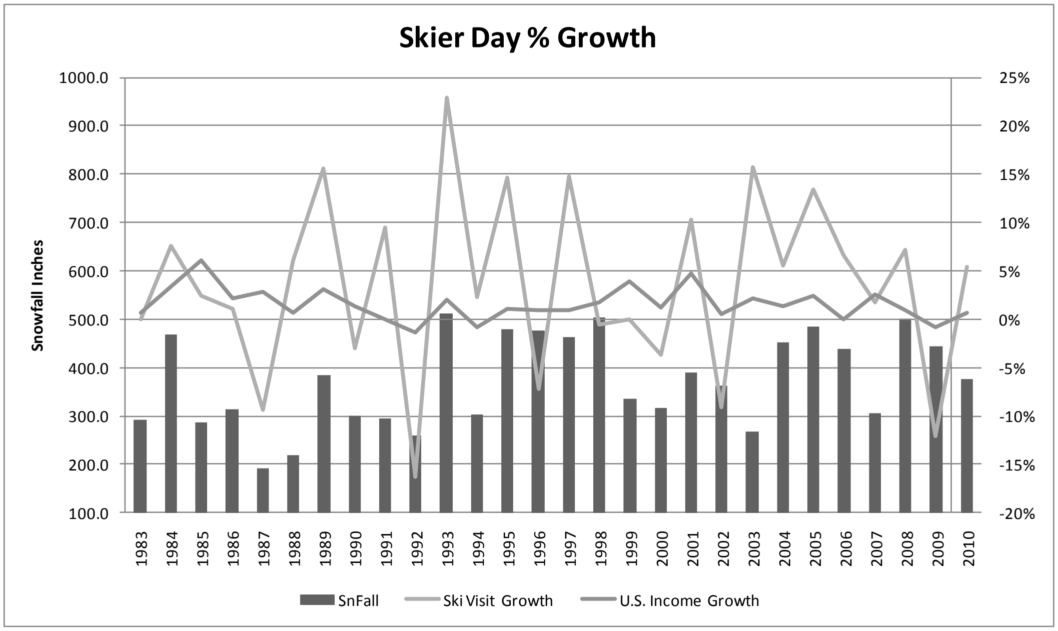

Figure 8 - Skier Day Growth, U.S. Disposable Income growth, Snowfall

4.1.2 Annual Snowfall

Another determinant of skier business is the amount of snow that falls in a particular area over a season. While most Utah resorts have implemented artificial snow making systems – including all three Park City resorts - annual snowfall is still reported by all resorts as part of their marketing packages, as it is widely thought that the amount of snowfall affects the overall ski experience.

The IBIS World Ski Industry Report indicates that ski resorts focus on two separate customer bases: the local skier market, and the destination skier market. The local market is largely influenced by both ski conditions and travel time, while the destination skier market is influenced more by the entire vacation experience (nightlife, lodging, restaurants, etc) [1]. Local business therefore varies greatly due to unpredictable snowfall and other weather conditions. Resorts try to neutralize the volatility caused by weather conditions by marketing season passes, which are sold before the season begins, to the local communities. Resorts also combat the unpredictability of the weather by making artificial snow. All three Park City resorts, particularly

[1] IBIS World. "Ski Resorts in the US, IBIS World Industry Report 71392." January 2010. IBIS World. 6 June 2010 <http://www.ibisworld.com/industryus/default.aspx?indid=1653>

Deer Valley, keep most of their beginner and intermediate runs covered and well-groomed to ensure a positive skiing experience, despite the lack of any recent snowfall.

A series of data indicating annual snowfall at Park City Mountain Resort dating back to 1980 was provided by the media office of the resort. This data is considered to be representative of the rest of the ski market due to proximity of the other resorts and common weather patterns. The series indicates total snowfall over each season as measured at the summit of Jupiter bowl, which is the point of highest altitude at Park City resort and the area that receives the most amount of snow. The snowfall data, depicted above in Figures 6 and 7 along with skier days and income levels, is quite volatile with a low annual snowfall of 169 inches in 1981, a high of 512 in 1993, and an average annual snowfall of 365 inches. The ski visit equation was estimated using various lags of this series as well to determine if the snowfall of previous years might have an effect on the current year ski business, but the contemporaneous variable was the only one with any significance. It is interesting to observe in Figure 7 the effect that snowfall has on the growth in skier days. Almost without exception the years with the largest amounts of skier day growth are years reflecting both an increase in income growth *and* above average snowfall.

4.1.3 Skier Visit Equation

The results of the regression analyses to predict determinants of skier visits in the Park City ski area are depicted below as Equation 2. A full regression summary can be found in the appendix.

$$\underset{\text{(t Stat)}}{PCSkiDay_t} = \underset{(-4.1)}{-1099974} + \underset{(3.05)}{0.4141PCSkiDay_{t-1}} + \underset{(3.16)}{563.26SNWF_t} + \underset{(4.07)}{124.59USINC_{t-1}}$$

R^2 = .955, N = 27 (1983-2010)

Equation 2 – Park City Skier Days

While snowfall definitely does have a determining effect on the amount of skier visits in the region, disposable income proves to have greater long term effects, as indicated, in part, by the greater t-stat of 4.07.

The equation reflects that a one year positive increase of annual snowfall to 500 inches (nearing the 30 year record of 512 inches), would result in a 4.35% increase in skier days for that year, which is a considerable effect. However, the following year, as snowfall drops back to average levels, the amount of skier visits drops back to just 1.8% greater than the level prior to the shock, and within a few more years any positive effect on skier days has essentially disappeared.

On the other hand, the effect that change to disposable income has on skier days is a bit different, in part because disposable income experiences growth fairly continuously. In the 30-year time examined in this study, the average growth rate of real disposable income has been 1.36%. The series only reflects negative annual growth 5 total years throughout that time. An increase in the growth rate of disposable income from 0% to 1% for one year results in a 1.1% increase in skier days that first year. If the growth rate is reset to 0 after the first year, the impact of that one year of growth is still reflected in the number of skier days which increases through year 8 before it holds steady at a 1.88% increase. If the 1% increase in the growth remains permanent, the number of skier days continues to grow annually, reaching an increase of 18.2% in year 10.

The results of the estimated skier visit equation verify that the ski business of a destination resort area, such as Park City, Utah, is most heavily influenced by the national economic factors, such as U.S. disposable income per capita[1]. As visitors from around the country are a large part of the Park City business, and generally plan a trip long before the snow season has begun, snowfall has less of a long-term effect on business.

4.2 Supply

As described in Chapter 3, the supply variable used to examine the fluctuations in the price series is stock, which in this study is defined as the number of dwelling units within the municipal boundaries of Park City. The stock series can be defined by the following equation:

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[1] It is interesting to note that the skier day equation predicting Utah Ski Visits had similar results, except that snowfall has a larger significance relative to income growth. This reflects the fact that compared to the rest of the Utah resorts Park City is more of a national destination. The Park City skier day equation is used in this analysis as it is a more significant determinant of Price.

$$Stock_t = Stock_{t-1} + Permit_{t-1}$$

Equation 3 – Stock[1]

The equations predicting construction permits were estimated using different lags of the Price(Park City and Deer Valley), Stock, and Permits data series. Interest rates and skier visits were also included in the exercise as exogenous variables, but neither proved to provide any significance to the equations. The resulting permit equations are as follows:

$$Permit_t = 197 - 0.0664 Permit_{t-1} - 0.0487 Stock_{t-1} + 2.274 PCPrice_t$$

(t Stat) (2.18) (-0.378) (-2.936) (3.117)

$R^2 = .334$, $N = 29$ (1981-2010)

Equation 4 – Permit Equation (Park City Prices)

$$Permit_t = 45.08 - 0.044 Permit_{t-1} - 0.023 Stock_{t-1} + 2.316 DVPrice$$

(t Stat) (0.363) (-0.243) (-1.632) (2.759)

$R^2 = .291$, $N = 29$ (1981-2010)

Equation 5 - Permit Equation (Deer Valley Prices)

While the permit equations establish that construction permits can be hard to predict, both equations illustrate that price clearly has the largest effect on new construction. A 5% increase in price, for example, would cause a 12% increase in construction permits. However, this 12% increase in permits represents an overall stock increase of only 0.2%. Figure 9 below illustrates the construction permit series data and its relationship to the price index. While the amount of annual permits fluctuates considerably the general correlation with price fluctuations is reflected quite clearly.

The negative coefficients of the lagged Permit and Stock indexes counteract increases influenced by price over the next two years, but the effect is minimal. The effects of the variables in the

[1] The stock equation assumes that additions to stock are permanent, essentially ignoring demolition, which is assumed to be inconsequential in the Park City market.

permit equation will be examined further as part of the complete forecasting model discussed in the next chapter.

It should be noted that the permit equation examining the effects of Park City prices is noticeably more effective than that of Deer Valley Prices with a higher R^2 and more significant variables. Subsequently the Park City equation is examined more fully in the forecasting model detailed in this study.

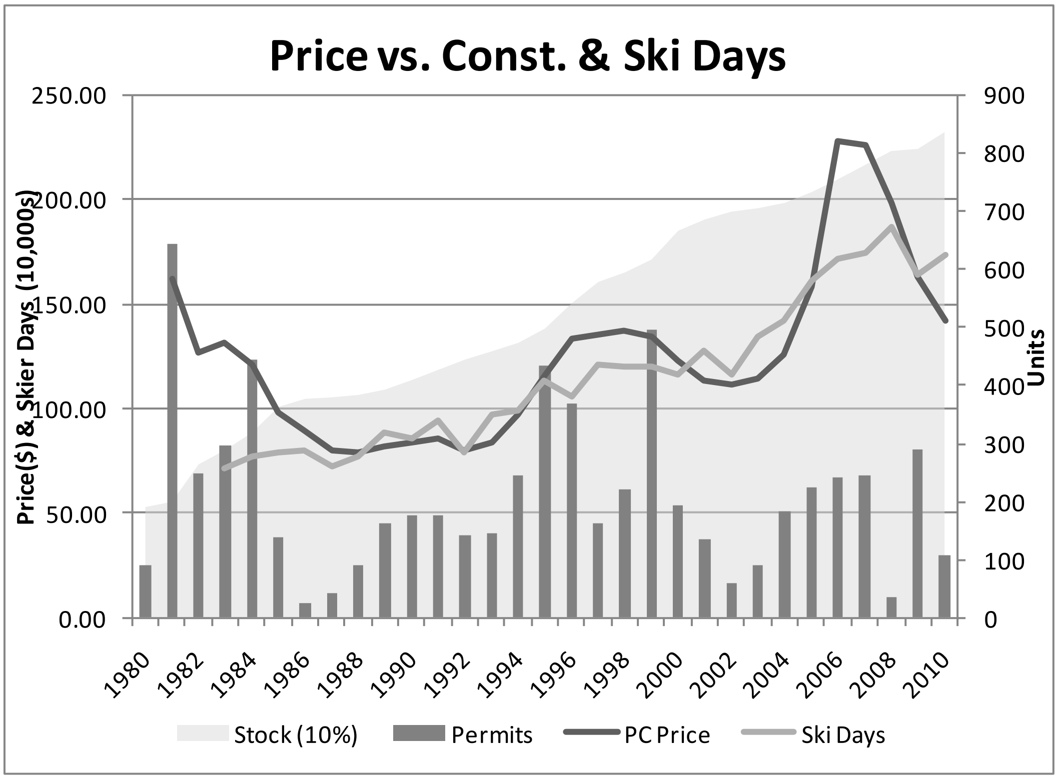

Figure 9 – Park City Prices vs. Construction & Skier Visits

4.3 Price

To examine the determinants of fluctuations in the price series, various equations were estimated using different lagged values of price, skier days, stock, and interest rates as the independent variables. It was surprising to observe that interest rates produced little significant effect on fluctuations of the Price series. This suggests that many second homes in the Park City market are purchased with cash, an argument supported in part by the National Association of Realtors 2009 Buyers Survey, which indicates that 3 in 10 vacation homes were purchased with cash[1]. The results of the various equation estimates also indicate once again that second order lags provide little significance in the prediction of price fluctuation. In fact the most effective equation also proves to be the most simple:

$$PCPrice_t = 5.653 + 0.4972 PCPrice_{t-1} + 0.000116 PCSkiDay_t - 0.0145 Stock_{t-1}$$

(t Stat)	(0.517)	(3.815)	(3.43)	(-2.429)

$R^2 = .864$, $N = 28$ (1983-2010)

Equation 6 – Park City Price Equation (Time Series)

$$DVPrice_t = 27.272 + 0.510 DVPrice_{t-1} + 0.0000756 PCSkiDay_t - 0.0103 Stock_{t-2}$$

(t Stat)	(1.826)	(3.787)	(2.455)	(-1.762)

$R^2 = .743$, $N = 28$ (1983-2010)

Equation 7 – Deer Valley Price Equation (Time Series)

The above equations depict that the price of Park City real estate is determined by SkierDays and Stock, supporting, quite simply, one of the basic principles of economics: that price is a function of supply and demand. While the price equation can be used to derive single-year calculations of supply elasticity, the long run effects of changes to these variables cannot be determined by this equation alone. This is due to the interdepency between the price and stock variable. But the price and stock equations together, combined with conditioning demand equation (skier days) will comprise the forecasting model which will enable the examination of the long run effects of variable fluctuations.

Figure 8 above also illustrates the Park City price series in relation to the number of skier days, stock, and construction permits (a measure of the change in supply). It can be observed that

[1] National Association of Realtors. Second Homes: Talking Points. 10 March 2010. 6 July 2010 <http://www.realtor.org/press_room_secured/public_affairs/tpsecondhomes>.

price follows the general growth trend of skier days, but that the growth in price is occasionally reversed, often in response to increased construction.

Comparing the Deer Valley equation to the Park City equation reveals that both markets behave similarly. The Park City model, however, appears to be slightly more effective, with a higher R^2 and more significant variables. The forecasting model examined in the following chapter will therefore be constructed with the Park City price and stock equations.

This price equation combined with the other equations predicting permits, stock, and skier visits (demand) make up the Vector Auto Regression forecasting model that is used to forecast levels of each variable, as well as to examine behavioral patterns caused by various shocks to the system, as discussed in the following chapter.

5.0 Forecasting Model

The equations derived in the time series analysis as detailed in chapter 4 are used to construct an econometric model that predicts the behavioral relationship between price, stock (as determined by new construction), and demand in the park city market based on the behavior of those variables over the last 30 years. In this particular model price and stock are the endogenous variables that are interdependent while the annual skier days is used as the conditioning variable that represents demand. The purpose of this model is to predict the reactions of the endogenous variables - price and stock – to fluctuations in either of these variables or the conditioning variable of skier days. As described in Chapter 4 fluctuations in skier days can be determined by snowfall and growth of real U.S. disposable income per capita, two completely exogenous variables. Therefore demand shifts in this model can be implemented simply by changing either of these two exogenous variables. The model is illustrated below in Figure 10.

$$PCSkiDay_t = -1099974 + 0.4141PCSkiDay_{t-1} + 563.26SNWF_t + 124.59USINC_{t-1}$$

(t Stat) (-4.1) (3.05) (3.16) (4.07)

R^2 = .955, N = 27 (1983-2010)

Equation 2 – Park City Skier Days

$$Stock_t = Stock_{t-1} + Permit_{t-1}$$

Equation 3 – Stock

$$Permit_t = 197 - 0.0664Permit_{t-1} - 0.0487Stock_{t-1} + 2.274PCPrice_t$$

(t Stat) (2.18) (-0.378) (-2.936) (3.117)

R^2 = .334, N = 29 (1981-2010)

Equation 4 – Permit Equation (Park City Prices)

$$PCPrice_t = 5.653 + 0.4972PCPrice_{t-1} + 0.000116PCSkiDay_t - 0.0145Stock_{t-1}$$

(t Stat) (0.517) (3.815) (3.43) (-2.429)

R^2 = .864, N = 28 (1983-2010)

Equation 6 – Park City Price Equation (Time Series)

Figure 10 – Econometric Forecasting Model

To illustrate the use of this model a forecast has been created based on a realistic demand scenario, with average annual snowfall and average growth of disposable income. Positive and negative demand "shocks" are then applied to the model, to create optimistic and pessimistic forecasts. The reactions of the variables to these shocks relative to the base case are then analyzed and the long run price elasticity of supply is calculated.

5.1 Base Forecast

To create the realistic forecast of price, construction, and skier days in the Park City market, the average annual snowfall of 365 inches and the average income growth rate of 1.36% were applied to the skier day equation for each year. The resulting 15-year forecast, compared with the actual values since 1980, can be observed in Figure 10 below. Table 4 below summarizes the forecast.

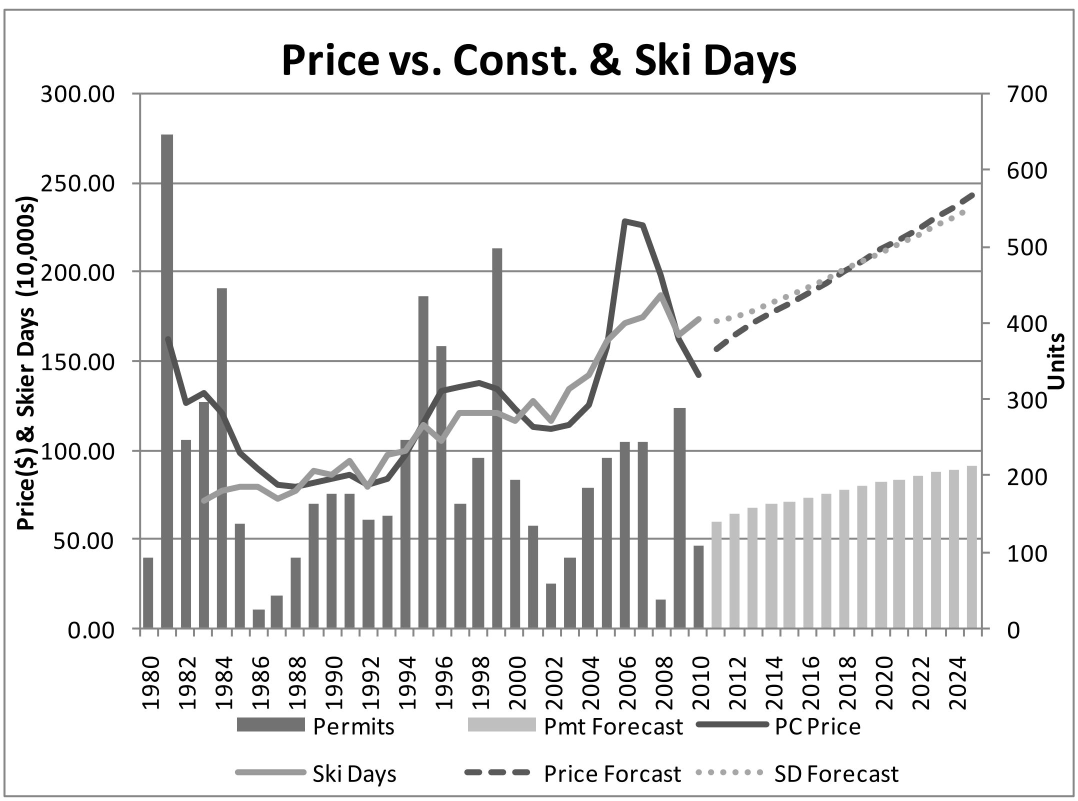

Figure 11 – 15-Year Forecast – Realistic Demand Scenario

Year	Real Price	Total Stock	Annual Permits	Skier Visits (Thousands)	Snowfall (in)	Dis. Inc. Growth	Disposable Income
Average 1981-2010	125.39	5,281	215.5	1,180	365	1.36%	12,257
Forecast 2010-2025					**365**	**1.36%**	
2010	$142.34	8,362	109	1,734	377		15,064
2011	$156.54	8,471	139	1,726	365	1.36%	15,269
2012	$164.66	8,610	150	1,749	365	1.36%	15,478
2013	$170.85	8,760	157	1,784	365	1.36%	15,689
2014	$176.59	8,916	162	1,826	365	1.36%	15,903
2015	$182.32	9,078	167	1,870	365	1.36%	16,120
2016	$188.16	9,245	172	1,916	365	1.36%	16,340
2017	$194.08	9,417	177	1,962	365	1.36%	16,563
2018	$200.07	9,594	182	2,010	365	1.36%	16,789
2019	$206.10	9,776	187	2,058	365	1.36%	17,018
2020	$212.17	9,963	191	2,107	365	1.36%	17,250
2021	$218.25	10,154	196	2,157	365	1.36%	17,485
2022	$224.37	10,350	200	2,207	365	1.36%	17,724
2023	$230.51	10,550	204	2,258	365	1.36%	17,966
2024	$236.68	10,754	208	2,309	365	1.36%	18,211
2025	$242.90	10,962	212	2,362	365	1.36%	18,459
Total Growth	**70.65%**	**31.09%**	**95.12%**	**36.20%**			**22.54%**
Ave. Growth	**3.63%**	**1.82%**	**4.56%**	**2.08%**			**1.36%**

Table 5 – Forecast 2010-2025, Realistic Scenario

The forecast predicts that prices start to recover quickly with a 10% increase in 2011, and a 5.19% increase the following year. Prices continue to increase, at slightly decreasing rates, through the 15 year period for a total increase of 70.65% and an average growth rate of 3.6.%. This forecast is consistent with the trailing 20-year trend, and is likely stimulated in the short run by the 2010 increase in skier days.

New construction permits are predicted to drop considerably from the unusually high number of 289 permits issued in 2009 to 109 permits in 2010. From there they increase a considerable 29% to 139 permits in 2011, 8% in 2012, and continue to respond to rising prices with annual increases, at decreasing rates through 2025.

Skier days in park city are predicted to slightly decrease (-0.5%) in 2011, after which they begin a steady increase between 2% and 2.5% each year for the remainder of the forecast.

These forecasted numbers appear reasonable with the implemented exogenous variables of average snowfall and income growth, suggesting a quick recovery in the short run and steady growth in the long run. This forecast also gives us a base case against which we can compare reactions to positive and negative demand shocks.

5.2 The Reaction of Forecast to Temporary Shocks

One of the benefits of the forecasting model is that once a base case is established the reactions to demand shocks can be examined more closely relative to that of the base case scenario. To do this an impulse response function is created that measures the percentage change in forecast from the base case as a result of the positive or negative demand shock. The traditional impulse response function measures reactions within a system caused by a transitory, or in this case a one-year shock to the system. In this section the system's response to multiple transitory shocks will be observed.

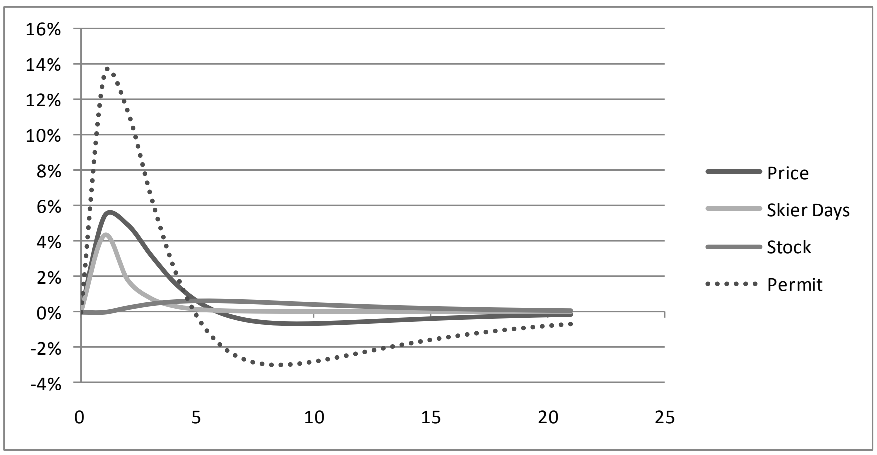

Figure 12 – Impulse response relative to base forecast, one-year demand shock of 500" of snowfall

The above figure illustrates the response of the system to a one-year increase in snowfall from 365 inches to 500 inches. It is interesting to note that the 4% increase in demand caused by the temporary increase in snowfall quickly disappears and the amount of skier days returns to pre-shock levels. Prices react in a similar manner, increasing 6% but decreasing again as the demand returns to original levels. However, construction reacts to the increase in price adding additional units to the market. Due to the fact that any increases in stock are permanent increases in this model, the increased supply, with no long term change to demand, causes prices to drop slightly below pre-shock levels in year 6. Construction quickly reacts by decreasing, which leads to a slow price recovery, starting in year 9. It should be noted that these percent changes are relative to the base forecast scenario specified in section 5.1. In this case, prices never actually fall below 2010 levels, they just fall slightly below the levels of the base case scenario. For example in 2019, post-shock prices reach $204.96 as opposed to $206.10 in the base case. The behavior exhibited in Figure 13 reflects typical market reactions to temporary increases in demand.

Figure 14 below illustrates that a negative temporary demand shock, caused by a decrease in snowfall, reacts similarly to that of the positive shock detailed above. This impulse response illustrates the effects of one year of reduced snowfall in the amount of 200”.

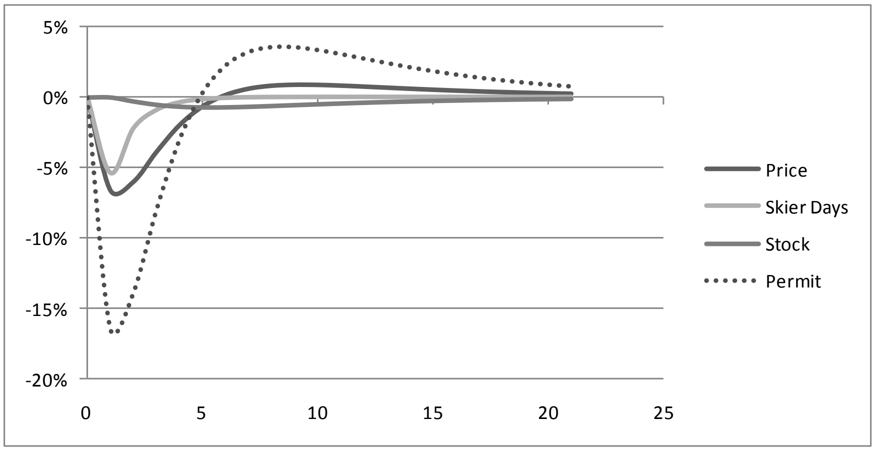

Figure 13 – Impulse response relative to base forecast, one-year 200” snowfall

The data illustrated in Figure 14 suggests that a temporary negative demand shift, caused in this case by reduced snowfall for one year, results similarly to the positive temporary shift in that price is reduced enough to slow construction and as a result, when demand returns to pre-shock levels, price actually appreciates above pre-shock levels. These mirrored reactions to positive and negative temporary demand shifts likely cancel each other out over time.

Figure 15 illustrates the response of the forecasting model to a one-year increase in the growth rate of U.S. disposable income, from 1.36% to 2.5%.

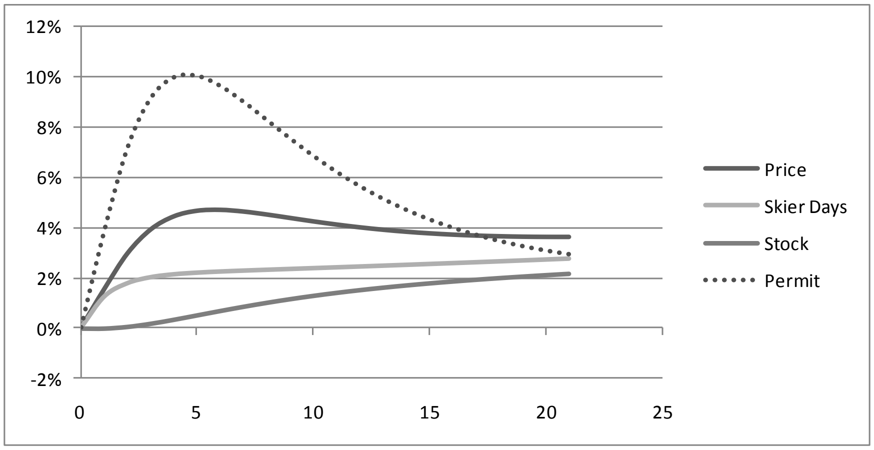

Figure 14 – Impulse Response relative to base forecast, one year shock of 2.5% income growth

Note that a one-year increase in growth of disposable income causes skier days to increase the following year, but in contrast to the increase caused by snowfall, this shift in demand appears to be permanent. It is interesting to observe that one year of positive income growth causes a 2% growth in skier days, leading to a 4.7% growth in price by year 5. Construction responds similarly with a 10% increase, causing prices to decline slightly, reflecting a 10-year price increase of 4.26% and stock increase of 1.3%.

Figure 16 below illustrates the effect of a one-year reduction in income growth from 1.36% to 0.5%

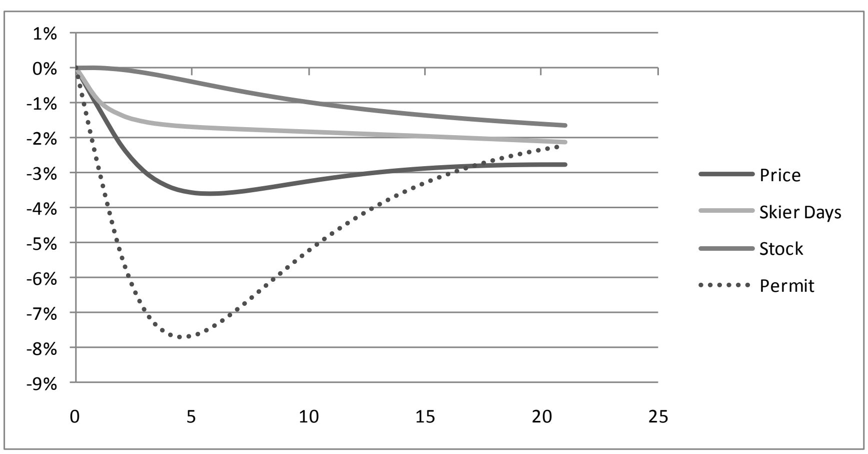

Figure 15 – Impulse response relative to base forecast, one-year shock of 0.5% income growth

It is observed in Figure 16 that the market reaction to a decreased growth rate of income mirrors that of an increased rate. A one year reduction in income growth to 0.5% results in a permanent demand shift, leading to a 5-year price reduction of 3.5%, reduced construction and a 10-year price reduction of 3.24%.

5.3 The Reaction of Forecast to Permanent Shocks

Another benefit of the impulse response function is that when used to reflect reactions of permanent demand shocks it can also be used to calculate the long-run price elasticity of supply. Consider figure 17 below.

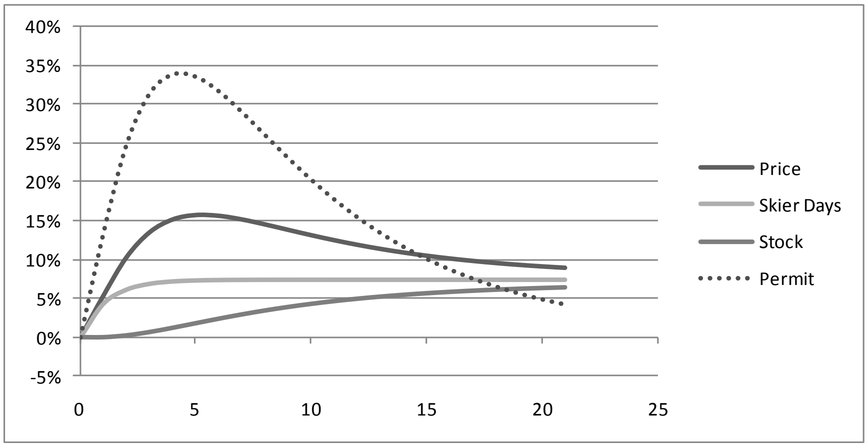

Figure 17 – Impulse response relative to base case, permanent shock of 500” snowfall

Figure 17 illustrates that a permanent shift in snowfall is predicted to cause a permanent 7% shift in skier days, relative to the base case. This shift causes prices to rise 15% over 5 years, which in turn leads to a construction boom. The increase in stock causes the price increase to temper and the market eventually settles into equilibrium. While this permanent shift is an unlikely scenario, it can be used to represent a permanent shift in demand and the impulse response can be examined to calculate the implied long-run supply elasticity. This impulse response mirrors the typical reaction of any healthy market to a positive shift in demand, reflecting a relatively inelastic supply market.

Elasticity of supply is measured as the ratio of % change in supply (stock) to % change in price (price index). It is a measurement that reflects the responsiveness of supply to a change in price. As the impulse response reflected in Figure 13 represents the % increases in price and stock in response to a permanent shift in demand, it is possible to calculate the implied long run supply elasticity. In year 2 after the demand increase, for example, the price increase relative to the base case is 10.28% while the stock increase is 0.23% reflecting an elasticity of .02. By year 10, however, price has increased 13% and stock 4.29% reflecting a long run supply elasticity of .33[1]. An elasticity between 0 and 1 is considered to be relatively inelastic, and prices in a market with a relatively inelastic supply are expected to appreciate any time there is a permanent demand shift. In the Wheaton study which examined Loon Mountain ski resort in New England, this same exercise revealed that Loon Mountain has an *elastic* supply market that responds so quickly to any price increases that long run appreciation is not to be expected.

Figure 18 illustrates the forecast response to a permanent decrease in snowfall to 200".

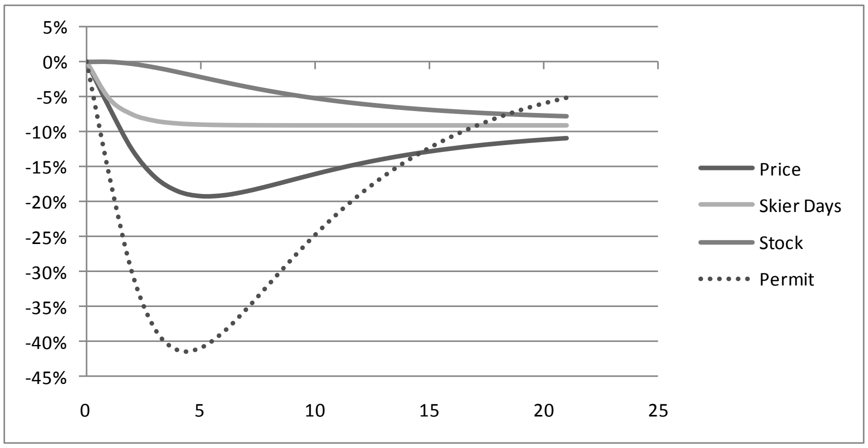

Figure 18 – Impulse response relative to base case, permanent 200" Snowfall

The impacts of the permanent reduction in snowfall are similar to those of increased snowfall. Prices depreciate nearly 20% in 5 years, but the reduced construction leads to gradual price recovery. The implied 10-year elasticity of demand is again 0.33, congruent with the positive increase scenario, which is expected, and suggests that the model is functioning properly.

A permanent increase in the growth of disposable income reflects a much different response:

[1] Long-run elasticity generally increases over short-run elasticity, especially in the housing market, as supply markets take time to react to shifts in demand.

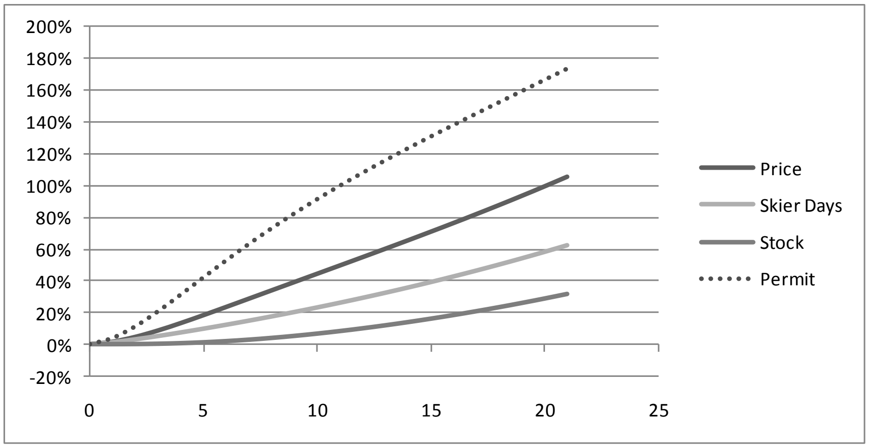

Figure 19 –Impulse response relative to base forecast, permanent 2.5% Income Growth

Figure 15 illustrates the system's response to a permanent increase of income growth to 2.5%. Not unexpectedly the system responds with considerable growth and price appreciation. Relative to the base case, skier days increase 39% over 15 years, price appreciates 70%, and stock grows 15.96%. When compared to Figure 17 above this chart again reflects that the Park City market is much more responsive to shifts in income growth than it is to snowfall.

The 10-year elasticity reflected in this scenario is .15, however this number is likely not representative of actual long run elasticity determined with permanent demand shifts, as the demand in this case is increased every year due to the compounding nature of the annual growth rate. The number is likely negatively influenced by the relatively smaller short run elasticity that is prevalent in real estate markets due to the length of time required to get new supply out to market.

The response to a permanent downward shift in income growth is illustrated in Figure 20 below.

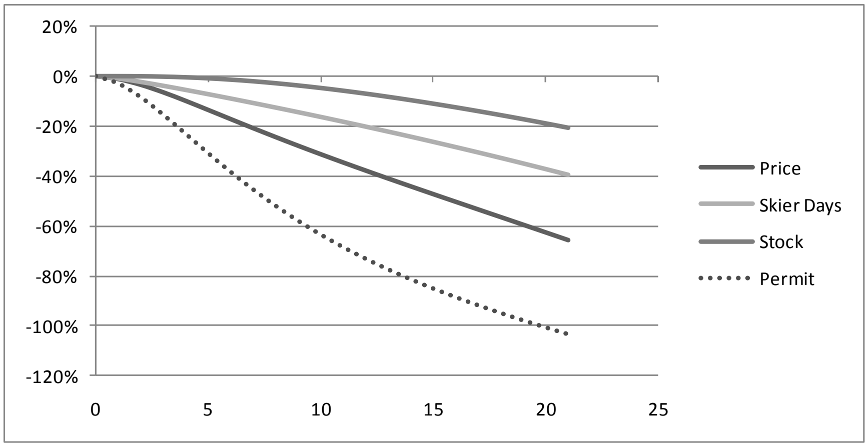

Figure 20 – Impulse response relative to base forecast, Permanent 0.5% Income Growth

As illustrated a permanent decrease in income growth causes a steady decrease in skier days, price, construction, and stock, relative to the base case, which mirrors the reactions of the positive shift of income growth. The 10-year change in price is -31%, and in stock -4.8%, implying a supply elasticity of .15, which again mirrors that of the positive shift.

5.4 Alternative Long-Range Forecasts

To provide perspective the econometric model was used to construct long-range forecasts based on best-case and worst-case demand scenarios. Figure 21 below reflects the 15-year forecast of price, construction, and skier days based on the optimistic demand shift caused by a permanent increase in annual snowfall to 500 inches combined with a permanent increase in growth of disposable income to 2.65%.

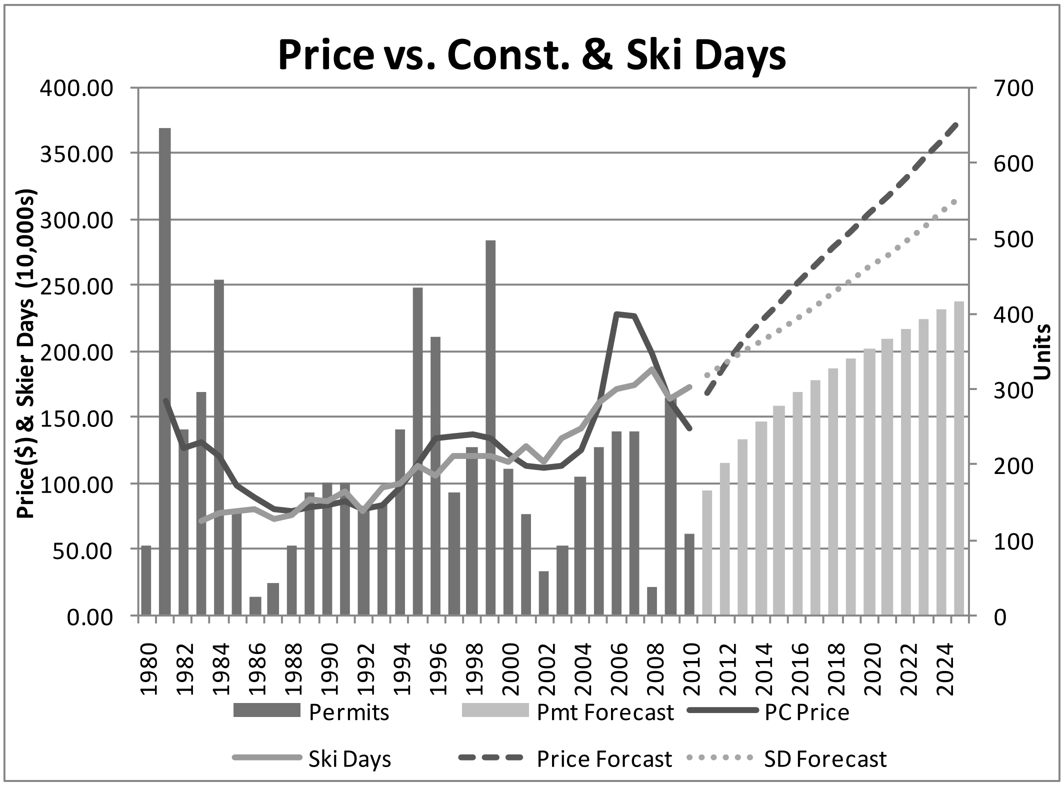

Figure 21- Optimistic Forecast – Increased Snowfall

In the above forecast, the permanent increases of both snowfall and disposable income cause skier visits to increase from 1.7 million in 2010 to 3.1 million in 2025, reflecting a 82% overall increase and average annual increase of 4.095%. Prices respond early with an 18% jump in 2011, an additional 13% in 2012, and a steady, but slowed increase thereafter for an average annual increase of 6.65%. Construction follows suit with steep increases in the early years, and solid growth thereafter reaching 418 permits in 2025.

While the future sustained growth reflected in Figure 21 isn't likely, it is interesting to observe that growth has occurred at similar rates for various different stretches in the past, and can be quite possible.

The forecast representing an assumed worst-case scenario is reflected in Figure 18.

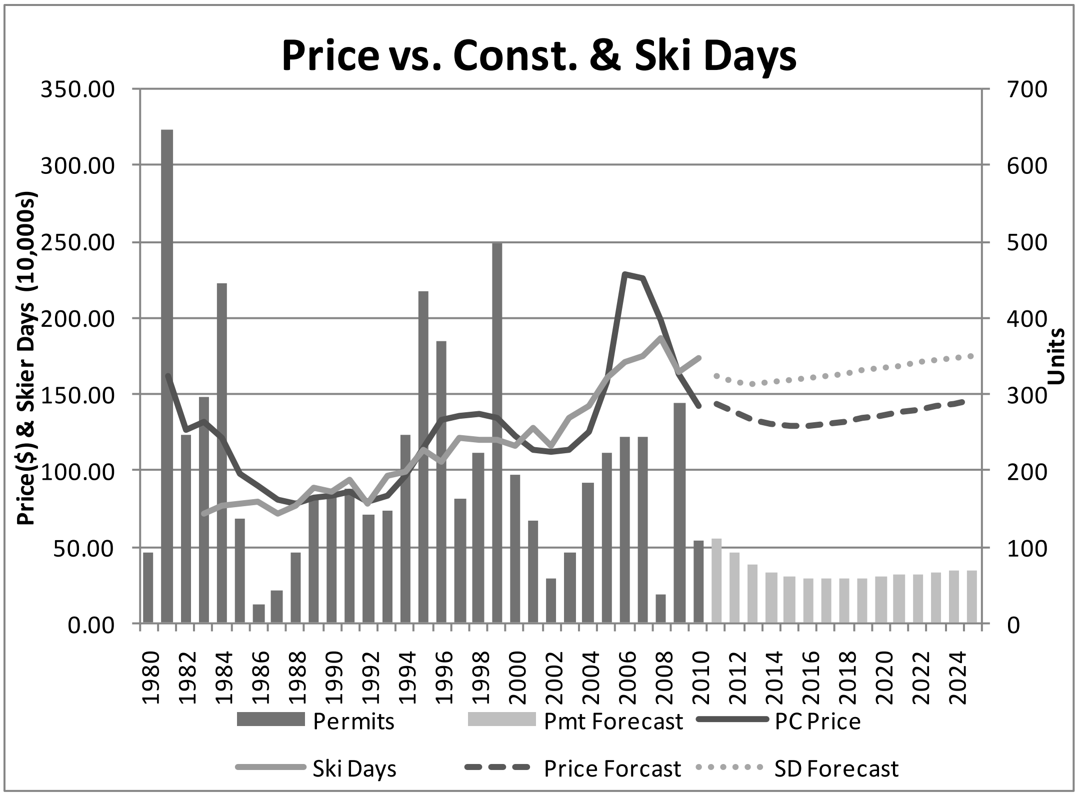

Figure 22 – Pessimistic forecast, .5% income growth, annual snowfall 200"

Figure 22 above reflects the 15 year forecast of the econometric model based on the demand inputs of 200" of annual snowfall and an annual income growth rate of 0.5%. These negative demand inputs have been selected to illustrate the system's long run reaction to an assumed worst-case demand scenario[1]. The system responds first with a 6.75% decrease in skier days in year one, followed by an additional 2.4% decrease in year 2, and a 0.4% decrease in year 3. Thereafter the ski business increases at very low rates. Prices follow demand with 4 straight years of depreciation, but a dramatic decrease in construction permits, which reaches a low of 58 in 2016, causes prices to start to recover slightly in the same year. Surprisingly, over the 15-year pessimistic forecast prices actually end up with a 0.2% overall growth, indicating that, in almost all cases, prices are likely to increase in the mid-term.

[1] Interestingly, it has been estimated that global warming, if not controlled, could result in average snowfall decreasing to amounts along these lines. Additionally, the Republican Party has expressed that excessive national debt could drag down long term national growth to 0.5% annually.(Wheaton)

5.4 Forecast Conclusion

The results of the forecast exercises indicate on all accounts that the Park City second home market is a well functioning market. While transitory positive demand shifts can result in overbuilding and reduced prices, long-run reactions of price and construction to permanent shifts in demand repeatedly reveal a relatively inelastic supply market. As such, any permanent positive shifts in demand should result in price appreciation. The forecasts also suggest that, considering recent market activity, prices should appreciate in coming years in all but the most pessimistic scenarios.

6.0 Conclusion

The purpose of this research project is to examine the market pricing behaviors of second homes in the ski resort market of Park City, Utah. To accomplish this, in order to track true price appreciation over time a real price index was constructed from 1981 to 2010 for 3 separate localized markets. The resulting price indices reveal a history of cyclical price movements, and surprising long-term price depreciation of 12% to 25% between 1981 and 2010.

To determine the causes of the cyclical movements in the price indices, time series regression analysis was performed, and a model was created to predict market behaviors based on past levels of price, construction, and skier days.

The results of this exercise reveal that the number of annual skier days in the area is an effective representative of demand, and that the local ski business has a considerable effect on real estate prices. Additionally, it is revealed that the area's ski business is largely affected by the health of the national economy, reflected specifically by U.S. disposable income per capita. The national economy appears to have more of an effect than the local and regional economy, which is congruent with the resort town's claim to be a national ski destination. This conclusion is also supported by the fact that the national economy has a greater effect on ski business than annual snowfall.

The analysis concludes that despite the thirty year decline in real prices, the Park City resort market behaves as a well functioning, healthy market. The model indicates that while increases in prices do stimulate new construction, the growth in the total number of dwelling units reveals a relatively inelastic supply market. This suggests that any growth in demand should be accompanied with long-term price appreciation.

To illustrate the utility of the model, market forecasts based on varied levels of future snowfall and U.S. disposable income levels are performed. The resulting forecasts indicate that except in the most pessimistic cases, prices in Park City should experience healthy appreciation in the near to mid future.

As an aside interest the data indicates that prices at Deer Valley, widely considered the more luxurious and expensive of the resorts, did not perform any better than those at Park City. In fact, data suggests that price appreciation at Deer Valley might be curtailed due to a slightly more elastic supply than Park City, which is more fully developed. Both markets, however, behave similarly and can expect to experience price appreciation unless the market changes drastically.

The question remains, however: if prices can be expected to appreciate in Park City, then why, over 30 years, have they decreased by 12%? The answer is likely to be, very simply, timing. Real estate is traditionally a cyclical market, and while covering 30 years should help negate any cyclical variations, the time period of this research project happened to begin at the precipice of a very steep and long lived price decline, and to end at the base(to be determined) of an even steeper price decline. Taking a closer look at the conditions in 1981 when this study begins, it is revealed that 1981 experienced the largest decrease in U.S. disposable income per capita over the study period, and the only second consecutive decrease. 1981 also reveals the largest amount of construction permits issued in Park City over that time period (645). Additionally, Park City Mountain Resort reports record low snowfall in 1981 (169”) and although skier visit data is not available for the Park City area in that year, total Utah skier visits decreased 16% that year, the largest decrease in the study period. In summary, 1981, the first year of our price index, experienced extraordinary circumstances that help to explain the subsequent fall in prices, and long recovery period.

The information provided through this study, together with that presented in the previous studies which examine the New England and Tahoe resorts, provides insight into the pricing behaviors of different resort communities. The results of these studies help to identify which resort characteristics lead to positive long-term appreciation. Potential second home buyers could use this information to help consider what characteristics to look for in a resort market, and in a location within that market, before making their home purchase. Additionally, Buyers and developers can both use the information in this study to help anticipate pricing shifts, so as to properly time their purchase and/or sale to maximize profits. On another note, city and resort planners could use this information to help develop planning strategies and building regulations to prevent overbuilding and to encourage price appreciation within their markets.

As the second home market continues to grow, information regarding the behaviors of the various markets can become more and more useful. It is hoped that the results of this study can help to provide transparency and perhaps lead to further studies of different types of markets in the vacation home industry.

Appendices

Appendix 1 – Data

Park City Housing Supply		
Year	Permits	Stock
1980	92	1,897
1981	645	1,989
1982	248	2,634
1983	297	2,882
1984	446	3,179
1985	138	3,625
1986	26	3,763
1987	42	3,789
1988	92	3,831
1989	164	3,923
1990	177	4,087
1991	176	4,264
1992	142	4,440
1993	147	4,582
1994	246	4,729
1995	434	4,975
1996	369	5,409
1997	164	5,778
1998	222	5,942
1999	497	6,164
2000	195	6,661
2001	135	6,856
2002	59	6,991
2003	92	7,050
2004	183	7,142
2005	224	7,325
2006	243	7,549
2007	244	7,792
2008	37	8,036
2009	289	8,073
2010		8,362

Table 6 – Housing Permit and Supply Data

Annual Skier Days		
Year	**Park City Area**	**Utah**
1980		2,055,000
1981		1,726,000
1982		2,038,544
1983	716,468	2,317,255
1984	771,222	2,369,901
1985	789,415	2,436,544
1986	798,311	2,491,191
1987	723,537	2,440,668
1988	767,786	2,368,985
1989	887,314	2,572,154
1990	861,242	2,500,134
1991	943,040	2,751,551
1992	788,830	2,560,805
1993	970,000	2,839,650
1994	992,000	2,808,148
1995	1,137,589	3,113,072
1996	1,055,857	2,954,690
1997	1,211,189	3,042,767
1998	1,204,399	3,101,735
1999	1,203,905	3,095,347
2000	1,158,911	2,959,778
2001	1,278,796	3,278,291
2002	1,161,734	2,984,574
2003	1,343,941	3,141,212
2004	1,418,345	3,429,141
2005	1,608,332	3,895,578
2006	1,715,536	4,062,188
2007	1,746,333	4,082,094
2008	1,871,540	4,249,190
2009	1,645,233	3,972,984
2010	1,734,025	4,048,153
Source:	*PC Chamber of Commerce*	*Ski Utah*

Table 7 – Annual Skier Days

Income Per Capita			Disposable Income Per Capita		
Year	U.S.	Utah	U.S.	RckyMtn	Utah
1974	5,707	4,745	5,002	4,528	4,244
1975	6,172	5,180	5,489	5,060	4,693
1976	6,754	5,760	5,965	5,537	5,157
1977	7,405	6,348	6,509	6,017	5,671
1978	8,245	7,054	7,215	6,778	6,291
1979	9,146	7,792	7,952	7,569	6,923
1980	10,114	8,501	8,802	8,443	7,584
1981	11,246	9,374	9,746	9,553	8,325
1982	11,935	9,973	10,410	10,171	8,852
1983	12,618	10,535	11,114	10,706	9,469
1984	13,891	11,431	12,294	11,737	10,325
1985	14,758	12,048	13,008	12,430	10,849
1986	15,442	12,426	13,626	12,609	11,176
1987	16,240	12,729	14,226	12,814	11,392
1988	17,331	13,192	15,271	13,591	11,803
1989	18,520	14,005	16,231	14,378	12,546
1990	19,477	14,913	17,108	15,253	16,149
1991	19,892	15,492	17,578	15,752	16,816
1992	20,854	16,115	18,478	16,609	17,430
1993	21,346	16,756	18,862	17,091	17,925
1994	22,172	17,566	19,550	17,702	18,364
1995	23,076	18,478	20,286	18,351	18,848
1996	24,175	19,529	21,089	19,136	19,159
1997	25,334	20,600	21,941	20,174	20,413
1998	26,883	21,708	23,163	21,698	18,937
1999	27,939	22,393	23,974	22,713	19,488
2000	30,318	24,517	25,955	25,069	21,454
2001	31,145	25,534	26,817	26,474	22,502
2002	31,462	25,648	27,816	27,152	23,061
2003	32,271	25,835	28,829	27,755	23,384
2004	33,881	26,837	30,309	29,133	24,325
2005	35,424	28,617	31,342	30,350	25,555
2006	37,698	30,337	33,174	32,055	26,850
2007	39,392	31,800	34,453	33,180	28,020
2008	40,166	32,050	35,464	33,939	28,585
2009	39,138	30,875	35,553	33,513	28,188

Source: Bureau of Economic Analysis, US Department of Commerce, March, 2010
Prepared by: New Jersey Department of Labor and Workforce Development, March

Table 8 – Income Per Capita

Appendix 2 - Regression Results

Park City Price Equation		**Linear**		
Dependent Variable		PC PSQFT		
Usable Observations		1141		
Degrees of Freedom		1101		
Centered R2		0.9153		
Uncerentered R2		0.9752		
Mean of Dep. Variable		184.3557		
Std. Error Dep. Variable		118.8623		
Std. Error of Estimate		35.1953		
Durbin Watson Statistic		1.0524		

	Variable	Coeff	Std Error	T-Stat	Signif
1	Constant	162.44067	10.93705	14.85233	0.00000
2	SQFT	-0.05319	0.00633	-8.40537	0.00000
3	BD	7.33155	2.38084	3.07940	0.00213
4	BA	5.74954	2.75265	2.08873	0.03696
5	ESTIMATED	46.58589	11.51448	4.04585	0.00006
6	CRSCTRDGE	29.49683	5.35168	5.51170	0.00000
7	PRKAVE	-13.36648	3.86007	-3.46276	0.00056
8	PDAY	-15.52728	5.19447	-2.98920	0.00286
9	RSRTCTR	52.34432	4.08142	12.82503	0.00000
10	SNWFLWR	75.05343	3.92061	19.14331	0.00000
11	SNWCRST	-19.48127	4.71674	-4.13024	0.00004
12	KNGS	0.00000	0.00000	0.00000	0.00000
13	D82	-27.86515	16.40575	-1.69850	0.08970
14	D83	-17.98790	14.28144	-1.25953	0.20811
15	D84	-23.73294	10.97678	-2.16210	0.03083
16	D85	-46.40642	10.82138	-4.28840	0.00002
17	D86	-54.17574	10.92280	-4.95988	0.00000
18	D87	-61.82388	11.01936	-5.61048	0.00000
19	D88	-59.72268	10.68071	-5.59164	0.00000
20	D89	-50.88892	10.23069	-4.97414	0.00000
21	D90	-42.07275	10.26986	-4.09672	0.00004
22	D91	-33.48901	11.02952	-3.03631	0.00245
23	D92	-38.79587	11.12932	-3.48592	0.00051
24	D93	-28.94996	10.42083	-2.77809	0.00556
25	D94	-4.13900	10.48495	-0.39476	0.69310
26	D95	30.32111	10.90866	2.77955	0.00554
27	D96	68.12208	11.89957	5.72475	0.00000
28	D97	76.96135	11.93028	6.45093	0.00000
29	D98	83.97963	11.75968	7.14132	0.00000
30	D99	83.37392	11.93362	6.98647	0.00000
31	D00	70.43984	13.15115	5.35617	0.00000
32	D01	57.93130	11.81522	4.90311	0.00000
33	D02	58.60940	11.17499	5.24469	0.00000
34	D03	68.45588	10.64579	6.43033	0.00000
35	D04	99.00437	10.35815	9.55812	0.00000
36	D05	177.17003	10.60170	16.71147	0.00000
37	D06	344.19221	10.93143	31.48647	0.00000
38	D07	354.02536	12.73700	27.79503	0.00000
39	D08	306.47834	13.20239	23.21385	0.00000
40	D09	221.81667	13.17617	16.83469	0.00000
41	D10	179.20066	16.45350	10.89134	0.00000
42	D08	0.75420	0.06181	12.20170	0.00000
43	D09	0.71390	0.05725	12.46939	0.00000
44	D10	0.82722	0.06992	11.83090	0.00000

Park City Price Equation	**Exponential**
Dependent Variable	LOG PC PSQFT
Usable Observations	1141
Degrees of Freedom	1101
Centered R2	0.9317
Uncerentered R2	0.9991
Mean of Dep. Variable	5.0411
Std. Error Dep. Variable	0.5871
Std. Error of Estimate	0.1561
Durbin Watson Statistic	1.2089

	Variable	Coeff	Std Error	T-Stat	Signif
1	Constant	5.05314	0.04853	104.13349	0.00000
2	SQFT	-0.00035	0.00003	-12.31441	0.00000
3	BD	0.03947	0.01056	3.73686	0.00020
4	BA	0.07057	0.01221	5.77826	0.00000
5	ESTIMATED	0.06268	0.05109	1.22689	0.22013
6	CRSCTRDGE	0.06212	0.02374	2.61634	0.00901
7	PRKAVE	-0.17330	0.01713	-10.11913	0.00000
8	PDAY	-0.18157	0.02305	-7.87829	0.00000
9	RSRTCTR	0.31156	0.01811	17.20544	0.00000
10	SNWFLWR	0.38570	0.01740	22.17323	0.00000
11	SNWCRST	-0.14921	0.02093	-7.13003	0.00000
12	KNGS	0.00000	0.00000	0.00000	0.00000
13	D82	-0.24817	0.07279	-3.40948	0.00067
14	D83	-0.22096	0.06336	-3.48721	0.00051
15	D84	-0.18286	0.04870	-3.75476	0.00018
16	D85	-0.35266	0.04801	-7.34524	0.00000
17	D86	-0.52647	0.04846	-10.86355	0.00000
18	D87	-0.58700	0.04889	-12.00631	0.00000
19	D88	-0.56096	0.04739	-11.83742	0.00000
20	D89	-0.44101	0.04539	-9.71577	0.00000
21	D90	-0.29965	0.04557	-6.57619	0.00000
22	D91	-0.25565	0.04894	-5.22412	0.00000
23	D92	-0.27062	0.04938	-5.48051	0.00000
24	D93	-0.21879	0.04624	-4.73201	0.00000
25	D94	-0.00837	0.04652	-0.17995	0.85722
26	D95	0.19150	0.04840	3.95657	0.00008
27	D96	0.41131	0.05280	7.79057	0.00000
28	D97	0.42614	0.05293	8.05063	0.00000
29	D98	0.49222	0.05218	9.43394	0.00000
30	D99	0.46636	0.05295	8.80807	0.00000
31	D00	0.41134	0.05835	7.04957	0.00000
32	D01	0.34381	0.05242	6.55861	0.00000
33	D02	0.36811	0.04958	7.42446	0.00000
34	D03	0.38998	0.04723	8.25643	0.00000
35	D04	0.51333	0.04596	11.16967	0.00000
36	D05	0.80409	0.04704	17.09451	0.00000
37	D06	1.23954	0.04850	25.55709	0.00000
38	D07	1.19406	0.05651	21.12942	0.00000
39	D08	1.08261	0.05858	18.48193	0.00000
40	D09	0.90411	0.05846	15.46533	0.00000
41	D10	0.85648	0.07300	11.73241	0.00000
42	D08	0.75420	0.06181	12.20170	0.00000
43	D09	0.71390	0.05725	12.46939	0.00000
44	D10	0.82722	0.06992	11.83090	0.00000

Deer Valley Price Equation			Linear	
Dependent Variable			DV PSQFT	
Usable Observations			957	
Degrees of Freedom			914	
Centered R2			0.8969	
Uncerentered R2			0.9760	
Mean of Dep. Variable			167.4664	
Std. Error Dep. Variable			92.2087	
Std. Error of Estimate			30.2828	
Durbin Watson Statistic			1.0887	
Variable	**Coeff**	**Std Error**	**T-Stat**	**Signif**
Constant	195.41381	13.33080	14.65882	0.00000
SQFT	-0.04457	0.00384	-11.60089	0.00000
BD	6.33621	2.45821	2.57757	0.01011
BA	6.54443	2.47017	2.64939	0.00820
ESTIMATED	-15.23419	6.86106	-2.22038	0.02664
ASPNWD	-10.80041	5.24423	-2.05948	0.03973
CRCHVL	14.21784	6.18651	2.29820	0.02178
DAYSTAR	16.78282	6.24868	2.68582	0.00737
FAWNGRV	7.82101	4.26003	1.83590	0.06670
LAKESIDE	-2.98353	4.62123	-0.64561	0.51869
PINEINN	206.55328	7.40357	27.89915	0.00000
PINNACLE	41.46703	5.41212	7.66188	0.00000
PWDRRUN	67.99794	5.53112	12.29369	0.00000
QNESTHER	15.67690	4.89972	3.19955	0.00142
STNBRDGE	0.00000	0.00000	0.00000	0.00000
D82	-8.21333	13.96433	-0.58816	0.55657
D83	-9.08186	11.95503	-0.75967	0.44765
D84	-25.44559	12.03586	-2.11415	0.03477
D85	-40.69757	12.68962	-3.20715	0.00139
D86	-43.51195	12.30602	-3.53583	0.00043
D87	-66.20709	12.23543	-5.41110	0.00000
D88	-56.25544	11.95180	-4.70686	0.00000
D89	-51.19309	11.56919	-4.42495	0.00001
D90	-44.24295	11.86107	-3.73010	0.00020
D91	-49.14128	12.17619	-4.03585	0.00006
D92	-48.09970	11.77439	-4.08511	0.00005
D93	-38.62359	11.74625	-3.28816	0.00105
D94	-29.76084	11.70180	-2.54327	0.01115
D95	-8.52166	11.76263	-0.72447	0.46896
D96	31.53628	12.02559	2.62243	0.00888
D97	41.95352	12.88809	3.25522	0.00117
D98	51.48673	12.68251	4.05966	0.00005
D99	50.00029	12.78804	3.90993	0.00010
D00	39.80783	12.24294	3.25149	0.00119
D01	38.10879	12.39202	3.07527	0.00217
D02	28.87965	12.62340	2.28779	0.02238
D03	38.32283	12.68363	3.02144	0.00259
D04	44.57063	11.70470	3.80793	0.00015
D05	111.51562	11.96286	9.32182	0.00000
D06	252.92460	12.59034	20.08878	0.00000
D07	261.63890	12.66697	20.65521	0.00000
D08	158.41566	14.69661	10.77906	0.00000
D09	146.01905	13.61268	10.72670	0.00000
D10	189.00081	16.62476	11.36864	0.00000

Deer Valley Price Equation	Exponential
Dependent Variable	LOG DVPSQFT
Usable Observations	957
Degrees of Freedom	914
Centered R2	0.9264
Uncerentered R2	0.9994
Mean of Dep. Variable	5.0060
Std. Error Dep. Variable	0.4589
Std. Error of Estimate	0.1274
Durbin Watson Statistic	1.4380

	Variable	Coeff	Std Error	T-Stat	Signif
1	Constant	5.22403	0.05607	93.17533	0.00000
2	SQFT	-0.00027	0.00002	-16.54166	0.00000
3	BD	0.05773	0.01034	5.58428	0.00000
4	BA	0.01962	0.01039	1.88830	0.05930
5	ESTIMATED	-0.04424	0.02886	-1.53295	0.12563
6	ASPNWD	-0.03162	0.02206	-1.43352	0.15205
7	CRCHVL	0.12598	0.02602	4.84179	0.00000
8	DAYSTAR	0.15183	0.02628	5.77710	0.00000
9	FAWNGRV	0.06335	0.01792	3.53567	0.00043
10	LAKESIDE	0.04413	0.01944	2.27055	0.02341
11	PINEINN	0.86995	0.03114	27.93875	0.00000
12	PINNACLE	0.26716	0.02276	11.73689	0.00000
13	PWDRRUN	0.40730	0.02326	17.50869	0.00000
14	QNESTHER	0.11685	0.02061	5.67018	0.00000
15	STNBRDGE	0.00000	0.00000	0.00000	0.00000
16	D82	-0.03479	0.05873	-0.59244	0.55370
17	D83	-0.08498	0.05028	-1.69019	0.09133
18	D84	-0.15274	0.05062	-3.01739	0.00262
19	D85	-0.22389	0.05337	-4.19500	0.00003
20	D86	-0.26932	0.05176	-5.20368	0.00000
21	D87	-0.38921	0.05146	-7.56334	0.00000
22	D88	-0.46099	0.05027	-9.17084	0.00000
23	D89	-0.45130	0.04866	-9.27509	0.00000
24	D90	-0.31891	0.04989	-6.39297	0.00000
25	D91	-0.35298	0.05121	-6.89274	0.00000
26	D92	-0.34557	0.04952	-6.97829	0.00000
27	D93	-0.27609	0.04940	-5.58869	0.00000
28	D94	-0.20449	0.04922	-4.15505	0.00004
29	D95	-0.01813	0.04947	-0.36652	0.71406
30	D96	0.20781	0.05058	4.10870	0.00004
31	D97	0.25947	0.05420	4.78693	0.00000
32	D98	0.31112	0.05334	5.83274	0.00000
33	D99	0.27747	0.05378	5.15890	0.00000
34	D00	0.25835	0.05149	5.01731	0.00000
35	D01	0.23682	0.05212	4.54385	0.00001
36	D02	0.19843	0.05309	3.73746	0.00020
37	D03	0.21836	0.05334	4.09345	0.00005
38	D04	0.27188	0.04923	5.52289	0.00000
39	D05	0.53963	0.05031	10.72533	0.00000
40	D06	0.97806	0.05295	18.47056	0.00000
41	D07	1.01052	0.05327	18.96806	0.00000
42	D08	0.75420	0.06181	12.20170	0.00000
43	D09	0.71390	0.05725	12.46939	0.00000
44	D10	0.82722	0.06992	11.83090	0.00000

The Canyons Price Equation	Linear
Dependent Variable	CN PSQFT
Usable Observations	896
Degrees of Freedom	860
Centered R2	0.9378
Uncerentered R2	0.9820
Mean of Dep. Variable	126.2498
Std. Error Dep. Variable	80.5453
Std. Error of Estimate	20.4868
Durbin Watson Statistic	1.3100

	Variable	Coeff	Std Error	T-Stat	Signif
1	Constant	122.88172	4.62732	26.55571	0.00000
2	SQFT	-0.01183	0.00177	-6.68959	0.00000
3	BD	1.58176	1.64112	0.96383	0.33540
4	BA	-6.74591	1.43887	-4.68835	0.00000
5	ESTIMATED	-4.15288	5.22088	-0.79544	0.42658
6	PKWV	-16.70125	3.94314	-4.23552	0.00003
7	PKWHC	-12.53119	1.73209	-7.23471	0.00000
8	REDPINE	0.00000	0.00000	0.00000	0.00000
9	D82	5.76702	6.02813	0.95669	0.33899
10	D83	-15.07629	5.31365	-2.83728	0.00466
11	D84	-19.96132	5.98171	-3.33706	0.00088
12	D85	-23.09929	6.58298	-3.50894	0.00047
13	D86	-44.79446	5.95452	-7.52276	0.00000
14	D87	-42.02295	5.61575	-7.48305	0.00000
15	D88	-40.31275	5.43067	-7.42317	0.00000
16	D89	-35.45655	5.31125	-6.67575	0.00000
17	D90	-30.63194	5.61457	-5.45580	0.00000
18	D91	-25.56679	5.80190	-4.40662	0.00001
19	D92	-23.03146	5.35395	-4.30177	0.00002
20	D93	-16.70496	5.16065	-3.23699	0.00125
21	D94	9.77136	5.47384	1.78510	0.07460
22	D95	34.25297	5.58158	6.13679	0.00000
23	D96	56.35550	5.82779	9.67013	0.00000
24	D97	63.13823	5.35913	11.78144	0.00000
25	D98	79.96018	5.81219	13.75733	0.00000
26	D99	72.55646	6.66830	10.88080	0.00000
27	D00	62.61223	6.42367	9.74711	0.00000
28	D01	67.03060	6.65022	10.07945	0.00000
29	D02	62.31909	6.63641	9.39048	0.00000
30	D03	52.45061	5.76022	9.10565	0.00000
31	D04	73.79207	5.42560	13.60073	0.00000
32	D05	153.29625	5.25736	29.15840	0.00000
33	D06	248.47321	5.76552	43.09640	0.00000
34	D07	261.25604	6.87050	38.02576	0.00000
35	D08	190.19640	7.60626	25.00524	0.00000
36	D09	116.86278	7.38219	15.83037	0.00000
37	D10	105.57185	15.14023	6.97294	0.00000
38	D07	1.19406	0.05651	21.12942	0.00000
39	D08	1.08261	0.05858	18.48193	0.00000
40	D09	0.90411	0.05846	15.46533	0.00000
41	D10	0.85648	0.07300	11.73241	0.00000
42	D08	0.75420	0.06181	12.20170	0.00000
43	D09	0.71390	0.05725	12.46939	0.00000
44	D10	0.82722	0.06992	11.83090	0.00000

The Canyons Price Equation			**Exponential**	
Dependent Variable			LOGCNPSF	
Usable Observations			896	
Degrees of Freedom			860	
Centered R2			0.9519	
Uncerentered R2			0.9993	
Mean of Dep. Variable			4.6625	
Std. Error Dep. Variable			0.5839	
Std. Error of Estimate			0.1307	
Durbin Watson Statistic			1.4071	

	Variable	Coeff	Std Error	T-Stat	Signif
1	Constant	4.78948	0.02952	162.26410	0.00000
2	SQFT	-0.00021	0.00001	-18.28761	0.00000
3	BD	0.01640	0.01047	1.56646	0.11761
4	BA	-0.00390	0.00918	-0.42482	0.67107
5	ESTIMATED	-0.03108	0.03330	-0.93314	0.35101
6	PKWV	-0.11504	0.02515	-4.57369	0.00001
7	PKWHC	-0.13049	0.01105	-11.81088	0.00000
8	REDPINE	0.00000	0.00000	0.00000	0.00000
9	D82	0.02587	0.03845	0.67290	0.50119
10	D83	-0.18910	0.03389	-5.57909	0.00000
11	D84	-0.25676	0.03816	-6.72910	0.00000
12	D85	-0.32117	0.04199	-7.64851	0.00000
13	D86	-0.63750	0.03798	-16.78405	0.00000
14	D87	-0.57516	0.03582	-16.05612	0.00000
15	D88	-0.55849	0.03464	-16.12214	0.00000
16	D89	-0.53160	0.03388	-15.69095	0.00000
17	D90	-0.39085	0.03581	-10.91325	0.00000
18	D91	-0.31264	0.03701	-8.44763	0.00000
19	D92	-0.27783	0.03415	-8.13522	0.00000
20	D93	-0.17833	0.03292	-5.41745	0.00000
21	D94	0.08349	0.03492	2.39105	0.01701
22	D95	0.30171	0.03560	8.47413	0.00000
23	D96	0.46149	0.03717	12.41421	0.00000
24	D97	0.49546	0.03418	14.49358	0.00000
25	D98	0.61249	0.03707	16.52056	0.00000
26	D99	0.55517	0.04254	13.05195	0.00000
27	D00	0.49850	0.04098	12.16587	0.00000
28	D01	0.53383	0.04242	12.58426	0.00000
29	D02	0.49615	0.04233	11.72051	0.00000
30	D03	0.44855	0.03674	12.20766	0.00000
31	D04	0.56877	0.03461	16.43442	0.00000
32	D05	0.93544	0.03354	27.89395	0.00000
33	D06	1.29609	0.03678	35.24196	0.00000
34	D07	1.31024	0.04383	29.89686	0.00000
35	D08	1.11569	0.04852	22.99519	0.00000
36	D09	0.83025	0.04709	17.63148	0.00000
37	D10	0.78287	0.09658	8.10622	0.00000
38	D07	1.19406	0.05651	21.12942	0.00000
39	D08	1.08261	0.05858	18.48193	0.00000
40	D09	0.90411	0.05846	15.46533	0.00000
41	D10	0.85648	0.07300	11.73241	0.00000
42	D08	0.75420	0.06181	12.20170	0.00000
43	D09	0.71390	0.05725	12.46939	0.00000
44	D10	0.82722	0.06992	11.83090	0.00000

Price Index – Log v. Linear

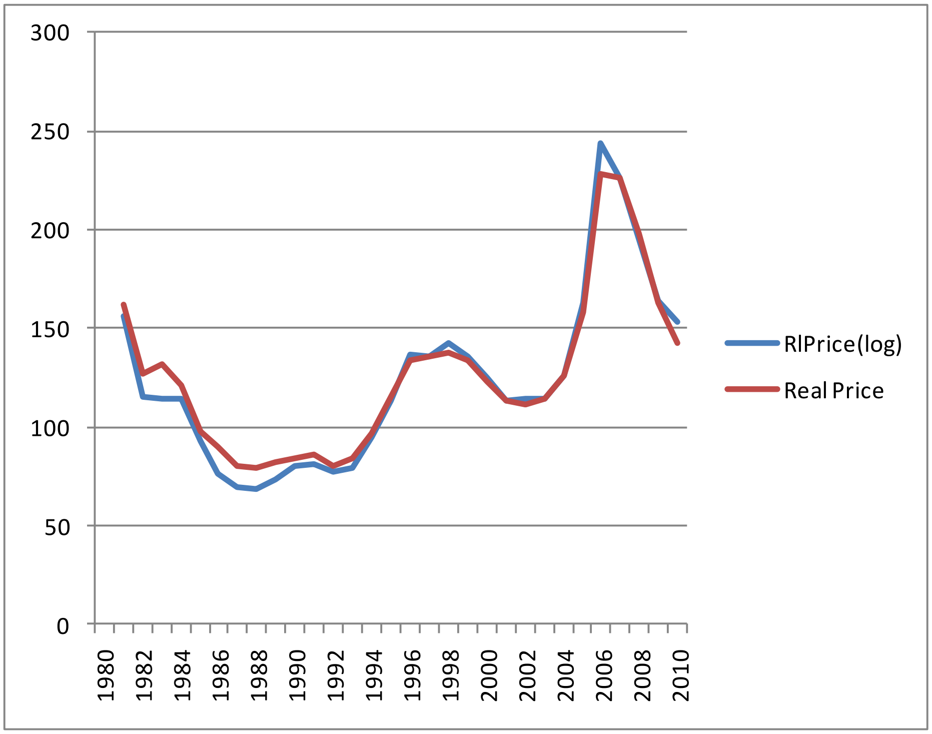

Figure 16 – PC Real Price Index – Linear vs. Log

Park City Ski Area Ski Day Equation

Regression Statistics	
Multiple R	0.97701
R Square	0.954549
Adjusted R Square	0.948621
Standard Error	79837.28
Observations	27

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	3.08E+12	1.03E+12	161.0135	1.41E-15
Residual	23	1.47E+11	6.37E+09		
Total	26	3.23E+12			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept (PCSkiday	-1099974	267651.2	-4.10973	0.000428	-1653653	-546296	-1653653	-546296
Sdays t-1	0.414106	0.135763	3.050222	0.005678	0.13326	0.694952	0.13326	0.694952
PCSnFall	563.2646	178.2133	3.160621	0.004371	194.6024	931.9268	194.6024	931.9268
U.S. Inc t-1	124.5875	30.63429	4.066928	0.000476	61.2156	187.9593	61.2156	187.9593

Park City Construction Permits Equation - Park City Prices

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.577994
R Square	0.334077
Adjusted R Square	0.254166
Standard Error	125.215
Observations	29

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	196641.4	65547.12	4.180621	0.015758
Residual	25	391970	15678.8		
Total	28	588611.3			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept (permits)	197.5641	90.30908	2.187643	0.038259	11.56903	383.5591	11.56903	383.5591
Prmt t-1	-0.06641	0.17555	-0.37828	0.708413	-0.42796	0.295144	-0.42796	0.295144
Stock t-1	-0.04872	0.01659	-2.93648	0.00703	-0.08289	-0.01455	-0.08289	-0.01455
Real Price	2.273626	0.729426	3.117008	0.004551	0.771345	3.775907	0.771345	3.775907

Park City Permits Equation - Deer Valley Prices

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.539582
R Square	0.291149
Adjusted R Square	0.206086
Standard Error	129.1879
Observations	29

ANOVA

	df	*SS*	*MS*	*F*	*gnificance F*
Regression	3	171373.3	57124.45	3.422774	0.032554
Residual	25	417238	16689.52		
Total	28	588611.3			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	45.08003	124.2797	0.362731	0.719855	-210.879	301.0388	-210.879	301.0388
Prmt t-1	-0.04375	0.180315	-0.24265	0.810258	-0.41512	0.327612	-0.41512	0.327612
Stock t-1	-0.02261	0.013859	-1.63178	0.11526	-0.05116	0.005928	-0.05116	0.005928
Real Price	2.316019	0.839372	2.759229	0.010682	0.5873	4.044737	0.5873	4.044737

Park City Price Time Series Regression

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.92940017
R Square	0.86378467
Adjusted R Square	0.84675776
Standard Error	16.1174596
Observations	28

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	39535.2004	13178.4001	50.7305426	1.5374E-10
Residual	24	6234.54012	259.772505		
Total	27	45769.7405			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept (Rprice)	5.65263577	10.9270373	0.51730726	0.60967696	-16.899661	28.2049322	-16.899661	28.20493215
Price T-1	0.49724341	0.13035453	3.8145464	0.00084077	0.22820488	0.76628194	0.22820488	0.766281941
PC SkiDays	0.00011644	3.395E-05	3.42989046	0.00219043	4.6375E-05	0.00018651	4.6375E-05	0.000186512
Stock t-1	-0.0144561	0.00595067	-2.4293179	0.02298241	-0.0267377	-0.0021745	-0.0267377	-0.00217449

Deer Valley Price Time Series Regression

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.861852554
R Square	0.742789825
Adjusted R Squ	0.710638554
Standard Error	14.85530371
Observations	28

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	15295.093	5098.3642	23.102969	2.95E-07
Residual	24	5296.3212	220.68005		
Total	27	20591.414			

	Coefficients	*tandard Errc*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	27.27227425	14.932799	1.8263337	0.0802662	-3.5475086	58.092057	-3.5475086	58.0920571
Price T-1	0.51011256	0.1346865	3.7874063	0.0009	0.2321333	0.7880919	0.2321333	0.78809186
Skier Days	7.55996E-05	3.079E-05	2.4554419	0.0216959	1.206E-05	0.0001391	1.206E-05	0.00013914
Stock t-2	-0.01033031	0.0058615	-1.7623998	0.0907347	-0.0224279	0.0017672	-0.0224279	0.00176724

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